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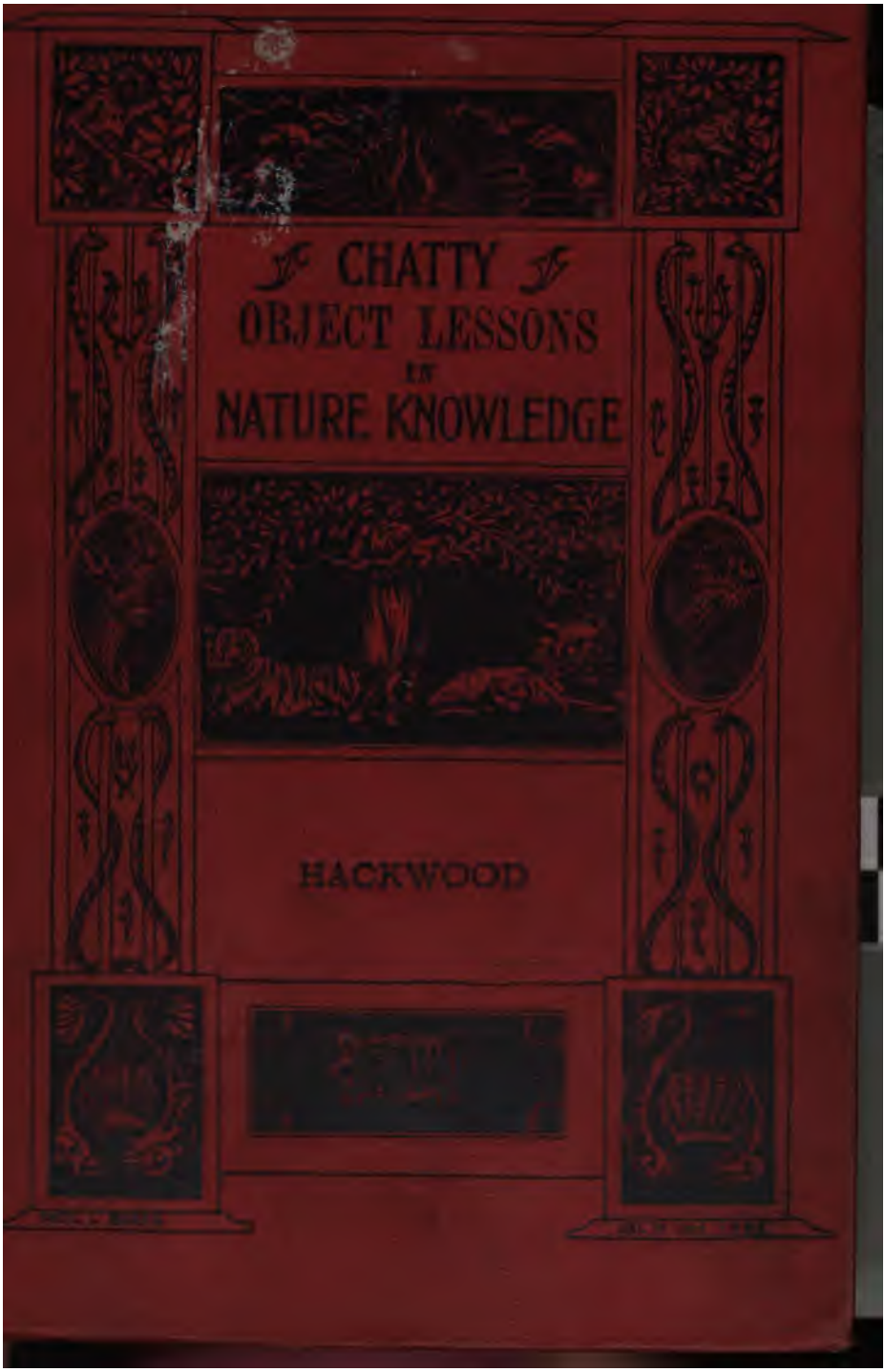
CHATTY
OBJECT LESSONS
IN
NATURE KNOWLEDGE
HACKWOOD

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IN

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LONGMANS, GREEN, AND CO.

NEW YORK

CHATTY OBJECT LESSONS IN NATURE KNOWLEDGE

BEING COMPANION OBJECT LESSONS TO LONGMANS' CHATTY READINGS IN ELEMENTARY SCIENCE

BY

F. W. HACKWOOD

LONGMANS, GREEN, AND CO.
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PREFACE

1. As stated on the title-page, these lessons are designed to accompany Longmans' Chatty Readings in Elementary Science, although the use of the latter as readers in the class is not essential to the value of this volume as a teacher's hand-book.

2. The chief feature of the Chatty Readings is the easy conversational style in which the lessons are presented. They are constructed for the conveyance of elementary scientific facts in the most simple manner, as many technicalities as possible being studiously avoided.

3. The scheme of subjects treated is fairly within the comprehension of pupils in the third and fourth year classes. It gives a knowledge of the principal animals, both tame and wild, with which every child ought to be acquainted; also an introduction to the leading features of plant life.

4. The teaching of kindness to animals is now universally recognised as a part of every child's education; throughout the whole of these lessons the humane treatment of animals is unobtrusively but consistently inculcated.

PREFATORY NOTE FOR TEACHERS

I. STAGE I., which is preferably the **Examination** of the **Objects** themselves when they are obtainable, must be the chief part of each lesson, inasmuch as it *arouses a living interest* in the subject. The teacher will merely guide the children in their *comparisons and contrasts*, and in all their other efforts to discover things for themselves.

Objects and Specimens should always be used **in preference to Pictures and Drawings**, so that children may familiarise themselves with the real thing, rather than a "counterfeit presentment" of it.

II. STAGE II. generally consists of **Questions and Answers**, by which the children may be led to tell what they know about the "Objects," and particularly what they have discovered about them for themselves. The teacher will carefully **refrain from "telling"** anything that it is at all possible to elicit from the children, being guided in the difficulty of the questions asked by the attainments of the class under instruction.

The questions and answers printed are merely **indicative of the line of thought** to be taken in working out the lesson. In actual practice many of the longer and more difficult questions will need to be broken up into a sequence of short and simple ones.

III. The succeeding Stages **gather up** all the **disconnected fragments of knowledge**, and **rearrange them in proper order**, while the **teacher supplements** them with what other items of information is

may be necessary for the children to be taught. In recapitulating and concluding, anything further of a *useful and practical* nature may be imparted, if the teacher shall think it comes fairly within the scope of the lesson.

IV. A number of outline drawings, white on black, are given to serve as models for blackboard work.

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PART I

I.—THE CAT

Object.—A Kitten (or Picture of Same). **Apparatus.**—Saucer of Milk ; a File.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of a Cat.		
(1) The feet have soft, fleshy **pads.**	Observation.	(1) Let children **feel** the pads of the cushioned feet.
(2) Five **hooked claws** on each forefoot and four on each hindfoot, which work in and out of **sheaths.**	Experiment.	(2) *Tempt* cat to stretch forth a paw **to clutch at something.** Let children notice that as the cat puts forth the paw to play, her claws shoot out, and she **may possibly scratch.**
(3) The **eye** is round. When held towards the light, the **pupil closes** to a mere line; but turned towards the dark, the **pupil expands** to a circle.	,,	(3) *Experiment* with the cat, holding **face to the window,** and then in a dark corner.
(4) The **teeth** are long and sharp.	,,	(4) Open cat's mouth to *exhibit* teeth. Show that all are sharp, that four longer ones are situated at the front sides, and that **no grinding teeth** are found at the back.
(5) The **tongue** is rough and dry. It can be curled into a scoop.	,,	(5) *Induce* cat to **lick** the children's hands to discover this roughness and dryness. *Give* cat a little *milk* in a saucer. *Observe* the **lapping** process.
(6) The **fur** is soft, thick, and smooth.	,,	(6) Let class *stroke* the cat to *discover* the softness, thickness, and smoothness of the fur.
STAGE II.—Questioning on Foregoing Examination of the Animal.		
(1) The padded feet are intended for a **noiseless approach** to prey.	Questioning.	(1) What do cats like to catch?—(**Mice.**) What would a mouse do if it heard a cat coming?—(**Run away** to its hole.) How does the cat get near the mouse or bird without frightening it away?—(**Creeps** softly upon it.)
(2) The claws are used for **clutching and climbing.**	,,	(2) If a mouse, or even a plaything, be dangled in front of a cat, what does she do at it?—(**Clutch.**) When she clutches at a thing, what enables her to hold it fast?—(**Sharp curved claws.**) When she takes back her paw, where do the claws go when she becomes quiet?—(**Into sheath.**)

A Cat's Paw: claws drawn in.

(3) The eyes open wide in the dark, so as to **help themselves to every bit of light** there is; and so it is often said "Cats can see in the dark."

(4) The teeth are long and sharp **for tearing flesh.** The cat cannot move her jaws sideways for **chewing.**

A Cat's Mouth.

(5) The rough tongue is used to scrape the **flesh from the bones,** to cleanse the fur, and to lap.

A Cat's Tongue.

(6) The fur is **soft and warm. Colours** vary.

Memory.

Q. or Telling.

"

"

Telling.

Experiment.

Questioning.

Memory.

Memory and Questioning.

When a cat runs **up a tree** or a wall, what enables her to cling and **climb so well?**—(Her sharp hooked claws.)

(3) If any child has gone into a **cellar or dark room** where there is a cat, what part of the cat has been seen **glaring through the darkness?**—(Eyes.)

A Cat's Paw: claws extended.

(4) Which kind of food, flesh or vegetable, does a cat like best?—(**Flesh.**)

What do we do with our back **grinding teeth?**—(Chew the food.)

Let teacher illustrate side movement of human jaws. Tell that cat cannot move jaws sideways.

If the cat **cannot grind her food,** will she **tear** off large or **small pieces?**—(Small.)

What does she at once do with each small piece?—(**Swallow it.**)

The four **long sharp** (canine) **teeth** act as skewers for **holding fast** a mouse, a bird, or any **struggling prey.**

Pupil of a Cat's Eye (Open).

(5) *Experiment* by smoothing a piece of roughly-sawn wood with a **file.**

Compare the rough **tongue** of a cat to a file.

If the cat can only **tear** the flesh from the bone, strip by strip, what has she to **finish the cleaning** of the bones?—(Her rough tongue.)

How does a cat **clean herself?**—(By licking with her tongue.)

Compare cat's tongue to a **sponge.** *Recall* her actions in **washing her own head.**

Pupil of a Cat's Eye (Shut).

(6) Which **way** ought a cat to be **stroked?**—(Front to back.)

Which is the better way for **fur to lie** on an animal that wants to creep **through narrow holes?**—(Front to back.)

Compare to **thatch,** all running in one direction.

THE CAT—*Continued*

Object.—A Kitten (or Picture of Same). **Apparatus.**—Saucer of Milk ; a File.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE III.—Habits and Characteristics of the Cat.		
(1) The cat is a **flesh-eating** animal.	Questioning. Reason.	(1) Recapitulate questions on **teeth formations.** *Show suitability* of teeth to the habits of the creature.
(2) Was originally [at first] a **hunting animal**, making its home in the **hollows of trees** and rocks.	Questioning.	(2) *Renew questions* on (*a*) **noiseless approach** to prey on soft foot-pads. ,, ,, (*b*) **clutching and climbing** powers of claws. ,, ,, (*c*) opening of the eye-pupil for **seeing when light almost fails.**
	Telling. ,,	*Connect* this kind of **sight** with **nocturnal** [nightly] habits of cat. *Add*—The **whiskers** or stiff hairs on the face are used as **feelers for night hunting**—useful in gauging width of a hole when seeking rats, rabbits, &c.
(3) The cat **dislikes wet,** or ruffled **fur.**	Memory.	(3) *Recall that*—A cat is **never** seen **swimming.** A cat after treading in water, will **shake the drops** from her paws.
	Telling.	*Teach that*—She has little natural oil in her fur to run off the wet. It is therefore cruel to wet her fur. She should always be stroked from head to tail. When she is licking herself clean, a bit of butter may be put on her paw to assist the operation.
(4) The cat **is a clean** animal.	,,	(4) *Lead up* to this from previous step. *Then add*—The cat is **without scent,** and her approach **cannot be smelt** by the keenest nose of mouse or rat. She is particular in her **food**, which must be **clean.**
STAGE IV.—Treatment of the Cat.		
(1) The cat is **not** made **useful,** but is only a **domestic** [house] **pet.**	Questioning and Telling.	(1) *Recall* the **uses** to which **dogs** are put ; then *contrast.*

(2) A cat should be well and **regularly fed.**	,,	(2) *Recall* that the cat was at first a "beast of prey," and therefore a **flesh-eater.** *Teach that*—**One meal of meat** (mixed with vegetables) at midday, now suffices for tame cats. **Porridge,** bread and milk, make good meals **at other times.** A cat **must have milk** each day, and always a good breakfast. **Starving** does not make a cat a better vermin-killer, but a **thief.** A cat needs a **supply** of clean fresh **water.** A **neglected** cat becomes a **nuisance.**

Review the whole of the Lesson by rapid Recapitulatory Questioning on the Salient Points of Each Stage.

Outline of a Cat.

II.—THE DOG

Object.—A Pup (or Picture of a Dog). **Apparatus.**—Picture of a Bear. Pictures of various Breeds of Dogs.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Dog (or Picture of same).		
(1) Toes have **soft pads**, and are used for walking upon, the **heel part being raised.**	Observation.	(1) *Let scholars examine* pads and feel their covering of **strong skin.** Show a picture of a bear or other sole-walker.
(2) Five **blunt nails protect toes** of each forefoot, four each hindfoot.	,,	(2) Let *examination disclose* that they are **not sharp or long claws** for clutching and clinging, but **mere protections**; and that they do **not work in and out** of sheaths.
(3) The **eyes are set prominently** in head; particularly those of a greyhound.	,,	(3) *Compare* prominence of eyes with a glaring **lamp** set at a **corner shop** to light down both streets.
	Telling.	The greyhound **hunts by sight**, and is sometimes called the gaze-hound.
(4) The **noses** of most dogs are drawn out **longer** than those of cats. Dogs have **keen scent.**	Comparison. Experiment.	(4) *Contrast* with **rounded head** of the **cat.** *Let dog smell* a bit of food, then hide it from him and let him **scent it out.**
(5) The **tails** of all dogs **turn upwards** at the end.	Observation.	(5) *Point out* this peculiarity on pictures.
(6) All dogs have a **few stiff hairs** on the sides of their **faces.**	,,	(6) *Discover* this peculiarity on the *living specimens.*
(7) Dogs never **perspire** through their skins, but when heated relieve themselves by lolling out their **tongues.**	Observation and Telling.	(7) *Exercise the living dog* by a smart run; then let class observe how the mouth is opened at the **quickened breathing,** and the **tongue protruded** for relief.
STAGE II.—Questioning on foregoing Examination of the Animal.		
(1) The dog belongs to the **toe-walkers.**	Questioning.	(1) *Compare* **dog's foot** with that of a **bear.** Why is it so **difficult** for a dog **to sit up steadily** on its hind feet, while a bear can sit up for any length of time?—(Bear is a **sole-walker**, using the whole of the foot from toe to heel, **as man does.**)

		What animals may we call **sole-walkers**?—(**Man, bear.**) But what kind of a walker shall we call the **dog**?—(**Toe-walker,** or **digitigrade.**)
(2) A dog's **nails are blunt,** and do **not work in and out**—(are not **retractile**).	,,	(2) Why **cannot** a dog **climb** a tree, as a cat can?—(No sharp claws.)
(3) Dogs have **good sight** and **quick hearing**: their power of **smelling** is **even keener.**	,,	(3) How do dogs **hunt** for, and find things?—(**Scent.**) Why is the greyhound sometimes called the **gaze-hound**?—(Powers of scent weak, therefore it **hunts by sight.**)
(4) Dogs can run far and fast without being much distressed.	Telling.	(4) *Explain* that we talk of "**hounding**" a person or thing when we mean "hunting" for it; that dogs are **naturally hunting animals**; that **man makes use** of this hunting instinct **for his own purposes.**
STAGE III.—Habits and Characteristics of the Dog.		
(1) The dog is a **flesh-eater.**	Telling.	(1) A dog has twelve **cutting teeth in front,** four tusk-like **canines,** and then about twenty-six **jagged back-teeth** for crunching bones.
	Memory.	Dogs are **fond of bones.**
	Telling and Memory.	Dogs do **not chew their food,** but bolt it; their back-teeth are not grinders, and they have **not the power of moving their jaws sideways** as chewing animals have.
(2) Although not a gentle herb-eating creature, but really a fierce flesh-eater, strong and swift, the dog has become man's **most faithful companion.**	Questioning.	(2) *Contrast* nature of a **dog** with that of a **cow or a sheep.**
(3) **Man has made many uses** of his characteristics; a dog is—	,,	
(*a*) **Swift** of foot.		(3)(*a*) How do we make use of a dog's **swiftness**?—(He **catches wild animals** for us.)
(*b*) Keen of **scent.**		(*b*) How do we make use of a dog's **keen scent**?—(He finds **hiding animals,** or **lost persons.**)
(*c*) An **enemy to vermin.**	Telling.	(*c*) *Name* animals which **seem to do harm** instead of good to us (rats, mice, &c.) as **vermin**?
(*d*) **Watchful** and faithful.	Memory.	(*d*) *Recall* **alertness** of watch-dogs, their usefulness in **guarding property,** and their never-failing **power to recognise** a friend.
(*e*) Possessed of powers of **endurance.**	,,	(*e*) *Recall* endurance of **carriage dogs**: the fact that the **Eskimo** find the dog the **only available beast of burden** in their snow-bound regions.

THE DOG—*continued*

Object.—A Pup (or Picture of a Dog). **Apparatus.**—Picture of a Bear. Pictures of various Breeds of Dogs.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE IV.—Some Uses of the Dog. (1) All the **hounds** are **hunting dogs.**	Memory and Telling.	(1) *Recall the names* of some—stag-hound, fox-hound, bloodhound, harrier, pointer, setter, retriever—and *briefly connect* the **name** with the **work done.**
(2) Many dogs are strong **swimmers.**	,,	(2) *Recall* names of some **water-dogs**—allude to **hairy feet** serving them as webbed feet—as Newfoundland, poodles, spaniels.
(3) The shepherd's dog is **a real worker.**		(3) *Note* that while some dogs are used **occasionally,** and often in our **pleasures,** the collie and bob-tailed English sheep-dog are **regular daily workers,** knowing their own flock from others, **understanding all commands** given by the shepherd, and barking at but never biting a sheep—a **remarkable change** from a **devourer** of sheep (as his wild cousin the wolf still is) to a **protector** of sheep.

Review the whole of the Lesson by rapid Recapitulatory Questioning on the Main Features of Each Stage.

A Dog's Foot

A Dog's Head

III.—THE HORSE

Object.—Picture of Horse. **Apparatus.**—Picture of Stag; Picture of Elephant; a Horseshoe; Bits; Horse-hair (as stuffing, and as woven hair-cloth).

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture of Horse (and Drawings of Details).		
(1) The horse is a **large animal**, with a **thick skin** coated with **glossy hair**, its **mane and tail** being of long **coarse hair.**	Observation.	(1) *Point out* these details of formation on the picture.
(2) It has a **handsome head**, and a **strong body** slightly curved as if **fitted to carry** a rider.	,,	(2) *Point out* and admire **graceful proportions** in so large an animal.
(3) Its four **legs** are long and thin for **speed**, yet having thick thighs for **strength.**	,,	(3) *Draw attention* to these points. *Contrast* with legs of stag and then with legs of elephant.
(4) Its **hoofs** are **solid**, and can be **shod** with iron for work on **hard roads.**	,,	(4) *Show* picture of hoof. *Contrast* with cloven hoofs of stag. *Exhibit* a horseshoe.
(5) Between the front teeth and the back teeth is **an empty space** into which the **bit is fitted.**	,,	(5) *Show* the bitted horse on picture, and details on drawings. *Exhibit* specimens of bits.
STAGE II.—Questioning on the Foregoing.		
(1) The horse is a useful **beast of burden** and a **beast of draught.**	Questioning and Telling.	(1) To **what use** is this large and strong animal put?—(To carry weights and draw loads.) *Use* both phrases, "beast of burden" and "beast of draught," and *explain* them.
(2) It has **speed and strength combined.**	,,	(2) By what machinery do men now **travel** when they wish to go **farther and faster** than they could walk?—(Train.) By whose aid did men **travel and carry loads** with them before **railways** were invented?—(By the aid of the horse.) *Bring out* this combination of **speed and strength**, and consequent usefulness to man.

THE HORSE—*Continued*

Object.—Picture of Horse. **Apparatus.**—Picture of Stag; Picture of Elephant; a Horseshoe; Bits; Horse-hair (as stuffing, and as woven hair-cloth).

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) Its **solid hoofs** are a **useful feature.** A Horse's Hoof (Shod).	Questioning and Telling.	(3) When is a **firm tread** more necessary, when we are light or **heavily laden?** when we are going slowly or **going fast?**—(When heavily laden; and when going fast.) Why do we **mend** our **roads?**—(To keep them even, smooth, and level as possible.) Does mending **make them harder** or softer than a field, for instance?—(Harder.) What **sort of feet** are **best suited** for travelling fast, and dragging heavy loads along these roads—the soft many-toed foot of a dog, or the hard, solid one-toed foot of a horse, **which can be shod** for further protection? A Horse's Hoof (Unshod).
(4) The formation of the **teeth** in a horse's mouth has enabled man to tame and **control** him **easily.**	,,	(4) When we want to work a horse and make him obey us, what is the **first thing we do** to him?—(Bit him.) How do we **guide** a horse?—(With reins.) To what are the **reins** fastened?—(To the bit.) **How** is it a horse can **hold the bit** in his mouth?—(The empty space allows the mouth to shut without the bit interfering with the closing.) *Demonstrate* with a penholder held in the mouth, crosswise, like a bit, that the teacher's **mouth** will not **close.**

	,,	*Claim* that the formation of the mouth has **decided the fate** of the horse as the servant of man. Recall how easily even a **child can guide and control** with reins this great strong creature.
STAGE III.—The Character of the Horse. (1) The horse is **docile, willing,** and **obedient.**	Questioning and Telling.	(1) **Which** is the **stronger,** a man or a horse?—(Horse.) Yet **which** is always **master**?—(Man.) *Recall* docility of a **great wagon horse,** using its great strength even under the direction of a weak child sometimes.
(2) It is **intelligent** and has a good **memory.**	Telling.	(2) *Tell* how quickly a horse learns—a wild horse **tamed** in a **few hours** after it is caught (*Mention* that wild horses exist in some parts of the world), and that a colt is **easily broken** by a good trainer. *Recall* how a **milkman's horse** soon knows the doors at which to stop.
(3) A horse is **seldom vicious** [wicked] unless made so by bad treatment; it **fights by kicking.**	Questioning.	(3) What **makes you afraid** of a person, bad or kind **treatment**?—(Bad.) Suppose you were **always going in fear** of a person, would you be likely to love that person, or to dislike **him**? *Show* how fear begets **vice.** How does a horse fight?—(By kicking.)
STAGE IV.—Some of the Uses of Horses.		
(1) A horse **carries loads,** and is called "a beast of burden."	Telling.	(1) *Recall* this name for a horse, and its application. *Gather* names of others, as ass, elephant, camel.
(2) A horse **drags loads,** and is called "a beast of draught."	,,	(2) *Connect* the word "draw" ("drag") and "draught." *Name* some **vehicles**; and parts of the **harness** used for attaching the horse thereto.

A Horse's Mouth.

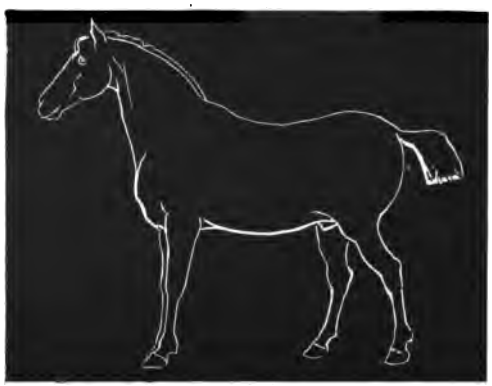
A Horse's Mouth.

THE HORSE—*Continued*

Object.—Picture of Horse. **Apparatus.**—Picture of Stag; Picture of Elephant; a Horseshoe; Bits; Horse-hair (as stuffing, and as woven hair-cloth).

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) The horse is **valuable** when **alive,** but has **little value** when **dead.**	Telling.	(3) *Contrast* with the cow, which is valued for its meat. *Detail* the uses—**Flesh** feeds dogs, cats, and poultry. **Hide** made into leather. [stuffing. **Hair** (tail and mane) woven into hair-cloth, or for **Bones** make buttons, egg-spoons, and small **Tendons** boil into glue. [turnery. **Hoofs** make snuff-boxes and similar trinkets.

Review the whole Lesson by rapid Recapitulatory Questioning on the Main Features of Each Stage.



Outline of a Horse.

IV.—THE ASS

Objects.—Picture of an Ass (and Drawings of Details); Picture of a Horse.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture (and detailed Drawings).		
(1) The ass, or donkey, is a **beast of burden, smaller** than the horse.	Observation and Memory.	(1) *Compare* its size and strength with those of the horse. *Note* that there are horses as small, known as **ponies.**
(2) Its **colour** is generally **grey**, with a **black stripe** from head to tail, **crossed** by another at the shoulders.	,,	(2) *Point out* on coloured picture, or *exercise the memory* on this point. *Note* exceptional colours, as of black, white, or brown donkeys.
(3) Its **ears** are **long**: its **tail** is **tufted.**	,,	(3) *Examine* picture for these details.
STAGE II.—Compared with the Horse.		
(1) The donkey is **like the horse** in—	Memory and Observation.	(1) (*a*) *Point out* the head-harness of a horse, and of an ass, showing **both bitted.**
(*a*) Having same **teeth formation,** which allows **bit** to fit an **empty** space.		
(*b*) Having a **solid hoof,** which is **shod** for work on **hard roads.**	,,	(*b*) *Show, by black-board drawings*, that hoof of an ass is **narrower** in proportion than that of a horse.
	Telling.	This narrow-pointed foot, with its hollow middle and sharp rim, is suited to the work of **hill-climbing.** The ass is more **sure-footed** than the horse.
(*c*) Having **loud voice,** which begins on a high note and goes down the scale to a lower.	,,	(*c*) *Compare* the **neigh** of a horse to a trumpet sound. *Admit* that the **bray** of an ass is discordant and harsh.
(2) The ass is **unlike the horse** in—	Questioning.	(2) (*a*) What is the **usual colour** of a donkey?—(Grey, or ash-colour.) What are the **different colours** a horse may be?—(Black, grey or white, brown, bay, chestnut, piebald, dappled, &c.)
(*a*) Being generally of **one colour.**		
(*b*) Having a **rougher coat, longer ears,** and a **tufted tail.**	,,	(*b*) Which has the **sleeker,** glossier, and more silky coat?—(Horse.)
	Telling.	*Explain* how a **shaggier** coat seems to be better **suited** with **ears** that are longer.
		Contrast thin, tufted tail of ass with thick, **bushy tail** of horse.

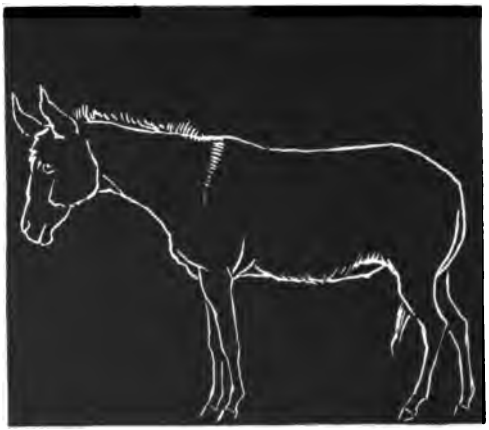
THE ASS—*Continued*

Objects.—Picture of an Ass (and Drawings of Details); Picture of a Horse.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE III.—Character of the Ass.		
(1) The ass is a **hardy** animal, and is often **unfairly treated.**	Telling. Questioning.	(1) For its size, the ass is **really stronger** than the horse. Which costs the **higher price** to **buy?** and more money to **feed**?—(Horse.) Which, therefore, does man **take** the greater **care of?**—(Horse.)
(2) The **food** of the ass is very **cheaply provided,** and he requires **less shelter** than the horse.	,,	(2) *Lead up to* (*a*) **Stabling** of the ass being **smaller,** and **poorer in accommodation**—a shed suffices. Food of the ass being such **herbage** as a **horse refuses**—thistles, and the weeds found on commons or along hedgerows.
(3) Mostly being in the hands of **poor owners,** the ass is often **neglected,** till he **becomes dull** and stupid.	,,	(3) Which gets the **better grooming**?—(The horse.) Which animal is better fed, and **better cared for** in every way?—(The horse.) Which of the two, the horse or the ass, is the more likely to be **high-spirited**?—(Horse.) *Demonstrate* that a **child** regularly subjected to blows, kicks, and ill-treatment would become **obstinate and spoilt in temper.**
(4) Yet the ass is an **intelligent** animal when **properly treated.**	Telling. Questioning. Telling. Comparison.	(4) The **wild ass,** found on the hot plains of Asia, is bold, fleet, nimble, frisky, and high-spirited. What is **one cause** of the ass being so **dull and slow** here?—(Ill-treatment.) Add a **second cause**—change to a wetter and colder **climate.** *Note* that a donkey will **avoid a puddle** of water, disliking even to tread in it. *Contrast* the large, handsome, and spirited **asses of the East** with the small, rough, slow, and heavy-looking **donkeys of this country.**

STAGE IV.—Uses and Treatment of the Ass.		
(1) The donkey is **useful** for **smaller loads** and **lighter draught** than those for which the horse is employed.	Questioning and Telling.	(1) *Suggest* **suitable tasks** for a donkey—drawing bathchairs and other invalid carriages, lawn-mowers, garden rollers, and costermongers' barrows. In proportion to size the ass is a strong animal, and provides the cheapest of motive-powers.
(2) For **mountain-climbing** the donkey is safer than a horse, being surer of foot.	Review. Telling.	(2) *Recall* the **form of foot**, which gives a "bite" to the tread. In mountainous countries and hilly parts the donkey is largely used.
(3) The ass needs regular **feeding,** proper **rest,** and good **grooming.**	,,	(3) To keep the animal in **good condition**, it should be fed with oats, carrots, and mangolds: grooming will produce **sleekness** in place of that ordinary **neglected appearance.**
(4) An ass should **not** be **overdriven** or **overloaded.**	,,	(4) *Limit* the **pace** to a slow trot, and the load **nothing beyond the weight** of two persons.

Review by Recapitulatory Questioning on the Salient Points in Each Stage.



Outline of a Donkey.

V.—THE COW

Objects.—Picture of Cow and Calf; Drawings of Details; Horn, Hoof; Specimens of Leather and Hide with hair on.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture, Drawings, and Objects.		
(1) The cow is a **large four-legged animal.**	Observation.	(1) *Compare* with **size** of horse and ass. *Use and explain* word "quadruped" (four-legged).
(2) The cow has four **cloven feet** and two **horns** of **material similar** to that of hoofs.	,,	(2) *Contrast* with solid hoof of horse and ass. *Show* that substance of **horn differs** from that of **bone.**
(3) It has a covering of **hair** (colour various) and a **tufted tail.**	,,	(3) *Glean* from class their knowledge of the **varying colours.** *Compare* **tail** with that of ass, and *contrast* with that of horse.
(4) Although its head, neck, and legs are **strongly built,** its body seems, even in comparison, to be a vast **bulk of bone and flesh.**	,,	(4) *Note* that cow's head and neck are **level** with body—**not erect** like that of horse. After *admiring* the **obvious strength** of limbs and neck, *call attention* to vast **mass** of bone and muscle contained in the bulky body.
(5) Notwithstanding its great size and strength, and its possession of horns, it is **a gentle-looking creature.**	,,	(5) *Hint* at the fearful possibilities if this great **strength** were **combined** with **fierceness.** Then, *in contrast, point out* **mild expression** of the domestic cow, and *rejoice* at its **slow habit** and gentle demeanour.
STAGE II.—Questioning on Foregoing Examination.		
(1) The cow is a gentle **grass-eating** creature.	Questioning and Memory.	(1) What do cows **eat?**—(Grass and other vegetable food.) **Which** animals are **the fiercer,** those that eat flesh or those that eat grass?—(Flesh-eater.) If an animal has to chase, catch, and **kill** another animal for its food, is it likely to be **gentle or fierce?**—(Fierce.)
(2) The cow is generally **slow of movement.**	,,	(2) If the animal has a very **heavy body,** set upon thick and (comparatively) short legs, is it likely to be **speedy or slow?**—(Slow.) If we desired the cow **to work for us,** as the horse does, has it **both speed and strength?**—(Strength, but not speed.) *Note* that cows work in some parts, and are then known as **oxen.**

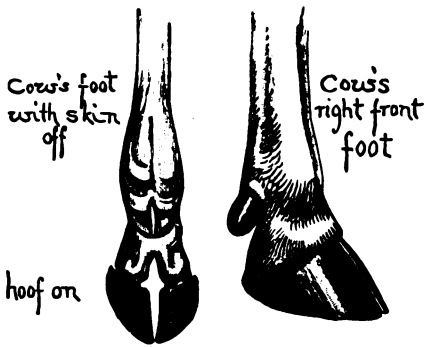
(3) The cow has **horns** to **defend** itself against attack.	,,	(3) For what purpose does a cow use its **horns**?—(Defence.)
STAGE III.—Habits.		
(1) The cow has **no teeth** in **front** of the **upper jaw**, but a hard **pad** against which the lower teeth can bite.	Telling.	(1) *Tell* (or *recall*) how the cow in **grazing** sweeps a tuft of grass into the mouth with its long **tongue**, and then gives an upward **jerk** of the head to tear off the herbage. The cow has **grinding teeth** at the back of the mouth.
(2) The cow is a **cud-chewing** animal. Or,	,,	(2) *Explain* that we chew with our teeth, swallow and digest our food right away in **one stomach**; whereas the cow swallows the food, brings it back from the first of its **four stomachs**, and gives it a thorough chewing while afterwards at rest. A round lump of food, thus brought back, is called a **cud.**
(2a) The cow belongs to that class of animals called **Ruminants.** [This step is not for Standards I. and II.]	,,	(2a) *Explain* to Standard III. as above, and then tell that we have a class of animals which chew the cud, or ruminate, and are called **Ruminants.** *Enumerate* cow, sheep, goat as **familiar examples**, and deer, camels, and the giraffe among the less known ruminants.
STAGE IV.—Characteristics. Treatment.		
(1) The cow likes to **live in herds,** and should not be kept singly.	Telling.	(1) *Note* **solitary** life preferred by some creatures (as the cat) and the preference of others for living together in **companies** (as "herds" of cattle, "flocks" of sheep). *Tell* that cows will **not fatten** when solitary.
(2) The cow is **fond** of her **calf.**	,,	(2) A cow moans and **grieves** when her calf is **first taken** from her.
(3) Cows do not like anything **red,** and bulls are made **fierce** by **wrong treatment.**	,,	(3) *Caution* against the **irritation** offered by a **red rag.** *Surmise* a repugnance to **blood,** as cows sometimes become fractious at the sight and smell of blood when driven to a **slaughter-house.**
(4) Cows need good **food,** pure **water,** and fresh **air.**	,,	(4) *Insist* on **cleanliness** in every part of **dairy work** and its surroundings.
STAGE V.—Usefulness.		
(1) The cow is one of our most **useful domestic animals.**	Questioning and Telling.	(1) *Name* some of our domestic (tame) **animals** and the **uses** we make of them?
(2) **Alive,** it gives us **milk,** which is an excellent food, and from which **butter and cheese** are made.	,,	(2) *Obtain* briefly from the class these various **uses of milk and cream.**

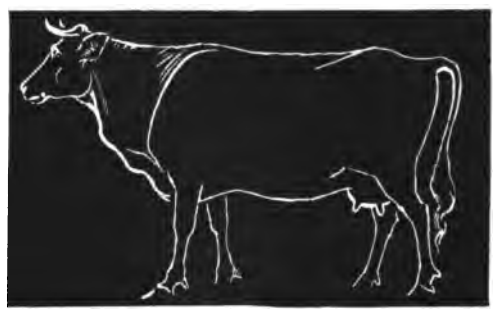
THE COW—*Continued*

Objects.—Picture of Cow and Calf; Drawings of Details; Horn, Hoof; Specimens of Leather and Hide with hair on.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) **Dead,** its flesh is called **beef,** and is a very nourishing meat.	Questioning and Telling.	(3) *Note* that the flesh of the **calf** is called **veal.**
(4) Its carcass also yields **suet,** a hide which is tanned into **leather, horns** that are made into cups and other small articles, and hoofs that (with parings of other parts) are made into **glue.**	,,	(4) *Enumerate* these **parts and their uses** very briefly.

Review by Recapitulatory Questioning on the Salient Points in Each Stage.





Outline of a Cow.

VI.—THE SHEEP

Objects.—Picture of Sheep and Lambs; Drawings of Details; Picture of Cow; Horns and Hoofs, and lower jaw of Sheep; Wool, Worsted; and Specimens of Woollen Fabrics, Parchment, Cat-gut.

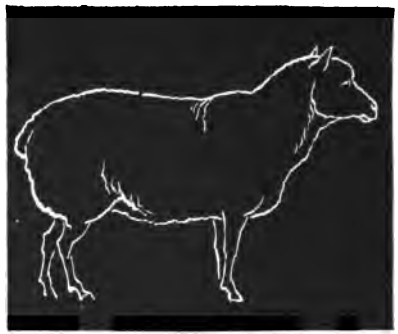
MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture, and Detailed Drawings.		
(1) The sheep is a **gentle-looking** creature **covered** with thick **wool.**	Observation.	(1) *Call attention* to thickness of covering adding to **bulkiness** of appearance. Hence *show* **apparent smallness** of head, and thinness of "shanks."
(2) It has four **cloven feet.**	,,	(2) *Point out* the **form** of the "trotters." *Contrast* with **solid hoof** of horse and ass.
(3) Some sheep have **horns** (males, or rams).	,,	(3) *Discover* that horns are **curved and hollow,** in material **like** the **hoofs.**
	Telling.	*Tell* that the **females** (ewes) **never** have horns, but **some males** (rams) have.
STAGE II.—Questioning on Foregoing Examination.		
(1) Its **thick coat** of wool **keeps** the sheep **warm.**	Questioning.	(1) **Why** will a sheep be able to **stand the cold** better than most animals?—(Covering of wool.) *Ask for* names of the homes or **shelters** we provide for a horse?—(a stable); for a cow?—(a cow-shed); for a pig?—(a pig-sty); for a sheep?—(no shelter is ever provided beyond **an open fold**).
(2) The sheep is a **timid grass-eater.**	,,	(2) Flesh-eating animals generally look fierce, but **what** shall we find this **gentle-looking** sheep **eats**?—(Grass.)
(3) The sheep sometimes fights by **butting** with its head.	,,	(3) Why is the ram, or male sheep, **sometimes armed** with horns?—(To fight, and protect itself.) **How** does a ram **attack** or fight its enemies?—(With its head.) What do we mean by "**ramming**"?—(Forcing or pushing hard.)

THE SHEEP—*Continued*

Objects.—Picture of Sheep and Lambs; Drawings of Details; Picture of Cow; Horns and Hoofs, and lower jaw of Sheep; Wool, Worsted; and Specimens of Woollen Fabrics, Parchment, Cat-gut.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE III.—Habits and Characteristics.		
(1) The sheep has **no teeth** in front of the **upper jaw**, but a hard **pad** sufficient for cropping grass.	Telling.	(1) *Exhibit* the lower **jaw** of a sheep (prepared). Sheep can **nibble** herbage **closer down** to the roots than cows. *Infer* that **sheep** feed on shorter grass of **hills**, while **cows** need long **meadow grass**.
(2) It is a **cud-chewing** animal.	Memory or Telling.	(2) *Recall* (or *tell of*) the sight of sheep, **after grazing**, lying down **to chew** their food **over again**.
(3) A sheep has **more than one stomach**.	Telling.	(3) **The food** is **received** in the **first stomach**, formed into balls or **cuds** in the **second**, then **brought back** to the mouth for **chewing**, and afterwards **passed** to the third and fourth stomachs for **complete digestion**.
(4) Sheep live together **in flocks**.	Memory or Telling.	(4) *Recall* (or *teach*) how the flock will follow one **leader**. Flocks in England reach the **size** of a few hundreds; but in Australia, of thousands.
(5) The sheep is **not** a very **intelligent** animal.	Telling.	(5) *Argue* that a creature which is **led** to its **food** and **safeguarded in every way** is **not likely** to become **sharp** or clever in any way.
STAGE IV.—Treatment.		
(1) The sheep **looks to man** for protection: requires **constant feeding** and naturally **gets fat**.	Telling.	(1) The word "shepherd" practically means a **protector** of the sheep. The **life** of a sheep is **made up** of **grazing** pasture after pasture. *Note* that as their **food cannot be brought** to them, the **sheep** are always **taken to the food**. The coating of **fat inside**, in addition to the coating of **wool outside**, protects from cold and makes **outdoor life**, at the coldest times and seasons, **no hardship**.
	Memory.	*Recall* the **fat** appearance of mutton.

(2) Sheep need **dry and well-drained land.**	Telling.	(2) *Draw* on the class's knowledge of **geography** to show that sheep are chiefly reared in **hilly countries and upland districts.**
	,,	*Mention* that sheep **rarely drink.** Tell that wet land is apt to give sheep rot in the **feet.**
(3) Sheep should be **sheared in the warm days** of spring.	,,	(3) *Describe* briefly the **operations** of washing and shearing. *Mention* that animals often **shed their coats** at approach of **warm season**—as we dispense with furs or overcoats.
STAGE V.—Uses.		
(1) All the wool of one sheep is **called a fleece:** wool is close, thick, soft **wavy hair,** used by man for **making many fabrics** and articles of clothing.	Telling.	(1) *Explain briefly* how the **fibres** are drawn out, twisted into **threads,** and woven into **fabrics.** Or some threads are **knitted.** Or some are beaten up into **felt.** *Enumerate* some **fabrics of wool**—broadcloth, flannel, blankets, carpets, hosiery, and felt. *Impress* on children the **debt of gratitude** due from us to the sheep.
	,,	*Note* that the **wool** may be **yielded** while the sheep is **yet alive.**
(2) Sheep are fed **in this country to provide us with meat.**	,,	(2) The meat is called **mutton.** Abundance of fat yields **suet** for **cookery.**
	,,	Surplus fat **is boiled into tallow** for making soap and candles.
(3) **Other products** are parchment (sheepskin) and cat-gut (intestines of sheep).	,,	(3) *Exhibit* **parchment,** and give its use and durability as a material **to write upon.** *Exhibit* **cat-gut,** and give its use in **musical instruments**—not forgetting that drum-heads are made of the other product, parchment.



Outline of a Sheep.

Review by Recapitulatory Questioning on the Salient Points in Each Stage.

VII.—THE GOAT

Objects.—Picture of Goat and Kid; Chamois Leather, Morocco Leather, and a Kid Glove.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture of Animals.		
(1) The goat is an animal about the **size of a sheep**, but **covered** with **long hair.**	Observation.	(1) *Discover* this **similarity** in shape and size, and **difference** in the two coverings. *Note* shaggy **beard.**
(2) While the sheep is fat, the **goat is lean.**	,,	(2) *Contrast* the thinness of goat's body with the thickness of **sheep's body.**
(3) The goat has **big horns**, and **cloven feet.**	,,	(3) *Point out* **horns**; then *discover* that **no** one ever saw a **goat without horns.**
STAGE II.—Questioning on Foregoing Examination.		
(1) The goat is **like the sheep** in shape and size, and in having cloven feet.	Questioning.	(1) *Gather* these **points of likeness.**
(2) The goat is **unlike the sheep** in its covering of hair, and in its slenderness of body.	,,	(2) *Gather* points of **difference.** If we suppose wool to be merely very wavy hair, **what kind of hair** shall we say the goat's is?—(Straight—and long.)
(3) While **all** goats **have horns**, only some sheep possess them.	,,	(3) If we look upon horns as **weapons of defence**, which of the two animals may we consider the braver, and the **better able to take its own part?**—(Goat.)
STAGE III.—Habits and Characteristics.		
(1) Goats need **no one to watch them**, but will come home at regular periods if food be placed in readiness for them.	Telling.	(1) *Remind* that we often speak of "shep-herds," but seldom of "goat-herds." Goats are **seldom** kept together in **flocks** for any **length of time.** They like to roam freely and find their own living as much as possible—they are independent and **more self-reliant** than sheep.

(2) Goats are good **jumpers** and very sure **climbers.**	,,	(2) Like sheep they are at home in **mountainous regions.** They are more **venturesome** than sheep; they frequent **rocky and bare regions, picking up a living** where sheep would starve. *Account* for the goat's spare and **lean body** by its **great activity**; as thus: "If an animal is always taking exercise, roaming abroad, clambering up hillsides, and skipping from rock to rock, is it likely to grow fat or to remain thin?"—(To remain thin.) Or, *question out.*
STAGE IV.—Treatment.		
(1) A goat should be provided with a little **stable,** fitted with **manger and rack.**	Telling.	(1) Like all animals it **needs light and ventilation,** and should be kept quite **clean and dry.** The little manger should be like a horse's, and its hayrack not too high.
(2) A goat will **eat surplus garden stuff,** roots, and vegetable parings.	,,	(2) Where a goat is kept **scarcely any green stuff** need be **wasted.** A goat is one of the **cheapest animals to keep.**
(3) To keep a goat in good condition, it must **not have much confinement,** and must be **regularly groomed.**	,,	(3) *Insist* that wild goats should have **plenty of fresh air.** *Recommend* **grooming** in the **open air** for greater sweetness. Or, *question out* reasons for this treatment.
STAGE V.—Uses.		
(1) The goat gives excellent **milk.**	Telling.	(1) Recommend its **strengthening qualities** for weak children and invalids. On the **Alps,** goats are kept in flocks for milch purposes; whence we get **Swiss condensed milk,** and **Gruyere cheese.**
(2) The **flesh** of the **kid is good to eat.**	,,	(2) *Call* it a kind of **venison.** *Name* the male a billy-goat, the female a nanny-goat, and the young a kid.
(3) The goat makes **a good stable companion.**	,,	(3) Goats and horses have a **strange liking for each other.** A horse will follow a goat out of a burning stable, when a groom's efforts to get him out would only seem to terrify him more.

THE GOAT—*Continued*

Objects.—Picture of Goat and Kid ; Chamois Leather, Morocco Leather, and a Kid Glove.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(4) The **skin** of the goat **makes leather.**	Telling.	(4) *Obtain* from class that **gloves** are made of kid [skin]. *Say* that **window leather,** sometimes called shammy leather, is made from the skin of the goat (originally that of the Chamois, or wild goat of the Alps). That **morocco leather,** largely used in bookbinding and upholstery, is tanned goat's skin.

Review by Recapitulatory Questioning on the Salient Points in Each Stage.

Outline of a Goat.

VIII.—THE PIG

Objects.—Picture of Pig ; Bristles.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS
STAGE I.—Examination of the Picture of the Pig.		
(1) The pig is an animal with a **thick body,** which is **thinly covered** with **bristles.**	Observation.	(1) *Observe* **general formation** of the pig, and its thick skin covered with a few very coarse hairs or bristles.
(2) It has **small legs** and **cloven feet** : its **tail** is **small.**	,,	(2) *Note* how the **trunk** of body is **bulky** while **legs and tail** are **small.**
(3) The **snout** is **strong** and armed with **strong teeth.**	,,	(3) *Show* that there is practically **no neck to destroy strength** of a bulky head set on a bulky body.
STAGE II.—Questioning on Foregoing Examination.		
(1) The **bristles** of the pig are very coarse hairs, set in a **skin of considerable thickness.**	Questioning.	(1) Which had the **finer and softer covering,** the cat or the dog? —(Cat.) As the **hair** of the dog was coarser than the **fur** of the cat, what is now found to be **coarser than** the dog's **hair?**—(Pig's bristles.) If the **bristles** of the pig are **so few in number,** may we expect the animal to be **further protected** by a **thick** or a thin **skin?**—(Thick skin.)
(2) The **carcass** of a pig **yields much meat.**	,,	(2) Does the **skeleton,** or **bone framework** of a pig, straggle into long limbs, or is it **compact** [close together]?—(Close together.) Is it generally **covered** with little or **with much meat?**—(Much.) When the **pig is killed** for meat, is it likely to **yield profitably** or unprofitably?—(Profitably.)
(3) Its **legs** are **short,** and it **cannot travel fast.**	,,	(3) If its **legs** are **short** and its **body** is **heavy,** will it be able to **travel** much or little? If a pig **gets little exercise,** is it likely to **become fat** or lean?—(Fat.)

THE PIG—*Continued*

Objects.—Picture of Pig ; Bristles.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(4) The pig has **strong jaws** and **long snout** for **rooting** into the ground.	Questioning.	(4) If the pig **picks up** things **with its mouth**, and it has **no neck** to reach with, may we expect it to have **long** or short **jaws**?—(Long.) If it finds **food** on and **under the ground**, should we expect the **snout** to be **strong** or weak?—(Strong.)
STAGE III.—Habits and Characteristics of Pig.		
(1) The pig is a **thick-skinned** animal.	Comparison.	(1) *Compare* with **other thick-skinned animals**—horse covered with hairs, elephant with bristles, &c.
(2) It seems to like **living in dirt.**	Telling.	(2) These animals with **thin covering of bristles merely roll in mud** to plaster themselves against **heat** and teasing **flies.**
(3) The pig has a **keen scent.**	,,	(3) *Review* the (*a*) formation ; (*b*) strength ; and (*c*) uses of **snout.** The pig can even **scent growing roots**, which it digs up with its snout and eats. The **teeth** are **suited** to habits—sharp front teeth for **nipping grass**, grinders for **crunching** all sorts of food ; **wild boars** have **tusks** for rending.
(4) The pig has **cloven feet**, but is **not a cud-chewer.**	Comparison.	(4) *Compare and contrast* with sheep—pig eats mixed foods, animal as well as vegetable.
	Telling.	A pig will not only **eat roots and acorns**, but will **graze like a sheep**, if allowed.
STAGE IV.—Treatment and Uses.		
(1) Pigs are fattened in **stys**, which should be warm, dry, and clean.	Telling.	(1) A grazing pig takes **too much exercise** to get fat. A sty should have a **litter** of dry straw—to keep animal **warm and healthy.**
(2) Although **not dainty feeders**, they should have servings of good meal, or milk, or potatoes.	,,	(2) *Object* to a diet **solely** of household **scraps—unwholesome feeding** produces unwholesome meat. *Approve* of barley-meal, small potatoes, butter-milk, waste grains, &c., as likely to make a healthy animal and **produce sound pork.**

(3) The **flesh** of the pig (**pork**) is **more savoury**, though **less wholesome** than beef or mutton.	,,	(3) Let class fill in *ellipses*— "The **flesh** of the pig **we call** —— ?"—("Pork.") "Pork is always of **better quality** if the pig has been **properly** —— ?"—("Fed.") *Allow* that pork is **tasty**, if **not so wholesome** as beef or mutton.
(4) Pork is **half fat**, and this fat "**takes the salt**" more readily than any other meat.	,,	(4) *Obtain elliptically* that "the **salted sides** of pork we call —— ?"—("Bacon.") ,, ,, "the **salted legs** we call —— ?"—("Ham.") ,, ,, "the **salted cheeks** we call —— ?"—("Chawls" or "Bath chaps.")
		Contrast the fat with the harder suety fat of beef and mutton.
(5) **Every part** of the pig is **made use of**; and it has consequently been called "the poor man's friend."	,,	(5) *Refer* to the **scrap meat** for **sausages** and pork pies. ,, **blood** ,, **black puddings.** ,, **inside fat** ,, **lard.** ,, **skin** ,, **saddle leather.** ,, **bristles** ,, **brushes.** All the entrails and other organs are cleaned, cooked, and eaten as a cheap and savoury food.

Review by Recapitulatory Questioning on the Salient Points in Each Stage.

Outline of a Pig.

IX.—FOWLS

Objects.—Picture of Fowls, or a Living Specimen in a Wicker Cage ; Fowl's Foot and Beak, and a Gizzard opened to show grit ; Specimen Feathers.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Specimen, or Picture of Fowl.		
(1) A fowl is a **large bird:** birds are covered with **feathers.**	Observation.	(1) *Compare* with **birds of the air:** have feathers stroked and admired.
(2) Its **body** is **large,** but its **wings** are **not.**	,,	(2) *Show* that, comparatively, the **wings** are **small** for so heavy a body.
(3) The **beak** is strong and pointed—it is a **horny mouth without teeth.**	,,	(3) *Contrast* with **beak** of the **duck.** *Open* the beak for examination by the class.
(4) The **legs** are fairly **long,** and have strong **rough toes.**	,,	(4) *Draw attention* to their strength, as if intended for **rough work.** *Count* the **toes:** *feel* the **nails.** Birds are **bipeds** [two-legged creatures].
STAGE II.—Questioning on Foregoing Examination.		
(1) These birds are classed among the **poultry**—birds with **large bodies yielding food** for man.	Questioning.	(1) Which are **easier to come near,** and to keep, fowls or birds of the air?—(Fowls.) *Name* other birds known as **poultry,** *i.e.* tame birds reared for human food.—(Turkeys, geese, ducks.) Why are **none** of these birds able to **fly far?**—(Heavy bodies.) How are these **heavy bodies profitable** to man?—(Yield much meat when killed.)
(2) They have **gizzards** for **grinding** up their **food.**	,,	(2) [If a living specimen is before the class, throw it some **corn to peck.**] How is the **pointed beak useful** to the fowl?—(For picking up grain and small food.) When we take **hard food** into our mouths [distribute some grains to be chewed], what must we do to it before swallowing it?—(**Chew it** with our teeth.)

	Telling.	*Show* that as **substitutes for teeth,** gizzards grind up the food **after it is swallowed.** *Exhibit* a gizzard, and *draw attention* to the **grit** the bird has swallowed to **assist the grinding** process—liken gizzard to an internal mill, and show its strength of **elastic muscle.**
(3) Fowls are **walking birds—**	Questioning.	(3) If fowls can **fly** but a **short distance,** how do they generally travel?—(They walk.) For what purpose, then, are their **legs long and strong?**—(For walking.) Then these birds, though they **seldom fly,** are **good** ——? —**(Walkers.)**
 A Hen's Foot.		
(4) and **scratchers.**	Memory. Questioning.	*Recall* that fowls **walk and strut,** but do **not hop** as sparrows do. (4) What are fowls **constantly doing with their feet** when turned upon their "run"?—(Scratching.) **Why** do they **scratch** up the ground?—(To find grain, seeds, scraps, and other bits of food.) *Name* some good places for fowls to "run"—places in which they can do something **towards finding their own living.** —(Farmyards, fields, hedgerows, &c.)
STAGE III.—Characteristics.		
(1) There are **many kinds** of fowls.	Questioning.	(1) Let class *very briefly name* as many as they know, with their **colours, sizes,** and **shapes,** just as far as they are **acquainted with** them.
(2) The male bird, or **cock,** is bold and gallant, and sometimes of brighter plumage.	Memory.	(2) *Recall*—how fine a **cock's feathers** are. —how **masterful** on his own "walk"—**crowing** a defiant challenge to strange cocks, **facing dogs** and other foes who threaten his hens.
(3) The female bird, or **hen,** is the best of mothers.	Telling.	(3) *Commend* the **patience** of the hen; when **sitting for three weeks** she will **forget to eat** in her anxiety to hatch every egg. And her **maternal** [motherly] **virtues** when she covers her chicks with her **protecting wings,** or **scratches up food for them,** calling them to it with an unselfish "cluck."
(4) **Chickens** are able to run about and feed as soon as they are hatched.	,,	(4) *Lead up* to this **precocity** from previous step. *Show* that chickens **merely need to be shown the food,** whereas young sparrows need to have it brought them.
(5) Fowls do **not build nests. None** of them **sing.**	,,	(5) *Contrast* with **birds of the air** in these two particulars.

Objects.—Picture of Fowls, or a Living Specimen in a Wicker Cage; Fowl's Foot and Beak, and a Gizzard opened to show grit; Specimen Feathers.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE IV.—Treatment.		
(1) Fowls need a sheltered and weather-proof **pen—**	Telling.	(1) *Tell* that fowls **came originally** [at first] **from the warm regions** of the earth—hence argue that they need warmth, and dislike cold and wet.
(2) with a **grass run** and a **gravel run.**	,,	(2) *Recall* knowledge of **scratching habits:** *prefer* **open freedom** to any fenced run. *Teach* that **gravel** supplies (*a*) **grit** for gizzard, (*b*) **lime** for formation of egg-shells, (*c*) a **dust-bath** — *remind* of the habit of scratching a hole in which to lie and scatter the dust over the body in order to **cleanse the feathers of vermin.**
(3) They **need feeding** with regularity and **method.**	,,	(3) *Recommend* **mixed diet** of grain, green food, and table-scraps boiled into a mass: also a good supply of **pure water,** which they **drink** frequently, and by holding up the head to **let it run down the throat.**

Outline of a Hen.

STAGE V.—Uses. (1) **Alive,** fowl supply us with **eggs.**	,,	(1) *Explain* that **eggs** are a very **nourishing food,** and that a hen lays from **200 to 300 a year.**
(2) **Dead,** its **plump body** supplies a delicate **food.**		(2) *Explain* that it **contains little fat,** and is easily **digested** by children and invalids.
(3) Its **feathers** are used to **stuff beds.**		(3) *Distinguish* these **soft downy feathers** from the quill or **shape feathers.**

Review by Recapitulatory Questioning on the Salient Points in Each Stage.

X.—PIGEONS

Objects.—Live Specimen in a Cage; Pictures of Various Breeds of Pigeons; a Fowl's Foot and Beak.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Specimens. (1) A pigeon is a bird **smaller than a fowl.**	Observation.	(1) *Show* that in size the pigeon seems to come **between poultry** and common **birds of the air,** such as sparrows, larks, &c.
(2) It has **large wings** and a **large tail.**	,,	(2) *Open* the **pinions to full expansion** to show large size as compared with the body.
(3) The **legs** are **small,** and not so strong and coarse as those of a fowl.	,,	(3) *Compare* with **fowl's foot,** which is larger and **coarser** in colour and substance.
(4) Its **beak** has a wart-like **knob** at its **base.**	,,	(4) *Point out* this protuberance. *Note* on **fowl's beak** the **scale-covered lateral nostril,** and the different position of pigeon's nostril.
(5) The **plumage** of pigeons **varies.**	,,	(5) *Show* this on picture. *Note* that **many** seem to have a **slaty colour**—the Blue Rocks perhaps lived in a **wild state** on rocky ledges of this hue.

Outline of a Pigeon.

PIGEONS—*Continued*

Objects.—Live Specimen in a Cage; Pictures of Various Breeds of Pigeons; a Fowl's Foot and Beak.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE II.—Questioning on Foregoing Examination.		
(1) The pigeon is **adapted** to [made for] long and swift **flight.**	Questioning.	(1) If a bird is built with **large wings to a light body,** what may we expect it to be able to do?—(Fly well.) With what are boats **steered** [guided]?—(A rudder.) Where is this **steering part placed**?—(At rear.) Of what **use** do you think a **bird's tail** is?—(To steer through the air with.)
(2) Pigeons, when **wild,** live mostly in trees, or in holes in **rocks.**	,,	(2) Why were the **feet of a fowl** made strong and coarse?—(**For scratching.**) If a pigeon flies to great heights, what must its **claws** be able to do when it **alights** on some **high and dangerous perch**?—(Clutch, cling, or perch.)
	Telling.	*Tell* these **habits of wild pigeons.** *Note* that pigeons can **walk like fowls.**
(3) Pigeons **vary** in **shape, according to breed.**	Observation.	(3) *Accept* the Blue Rock as the most **ordinary breed,** and **nearest to wild species.** *Point,* on picture, to erect and spreading tail of **fan-tail;** to puffed out breast (air swollen crop) of **pouter;** the veil feathers of **nuns;** &c.
STAGE III.—Distinguishing Characteristics from other Poultry.		
(1) In **formation,** pigeons differ from the larger poultry in their (*a*) large **wings,** (*b*) slender **legs,** and (*c*) shape of **beak.**	Questioning.	(1) *Recapitulate and focus previous steps* dealing with these points.
(2) In **habit,** pigeons are (*a*) birds of **flight,** (*b*) mostly **tree-dwellers.**	,,	(2) *Obtain by a rapid review,* as in previous step.

(3) Pigeons are **like the poultry tribe** in that— (*a*) They **come to us** for food and shelter. (*b*) They **walk about with other fowl,** eating same food, and roosting in dove-cot.	Telling.	(3) *Gather* these **likenesses,** if possible, *by questioning.* *Tell* that the **differences** have been thought to **outweigh these similarities** so much, that pigeons are **not classed with poultry by many writers,** but are made into a separate class by themselves.
STAGE IV.—Peculiarities and Characteristics.		
(1) Pigeons have a strong **love of home,** and a **propensity for finding** and returning to it **from great distances.**	Telling.	(1) **Instinct** [animal sense] teaches a pigeon to **find its way** home by **shortest route** and in **quickest time.** This **homing propensity** has been **turned to account** by man, who trains a breed of superior size and strength, called **carriers,** to carry messages for him. *Suggest* that the homing **power consists of** (*a*) very **keen sight,** as the pigeon first rises to a great height as if to scan the horizon; and (*b*) **unfailing memory,** affording a ready recognition of any familiar landmark that looms in sight.
(2) Pigeons **drink holding the bill in the water** till the thirst is quenched.	,,	(2) *Contrast* this with the **fowl,** which has to hold up its beak for the water to **run down its throat.**
(3) Pigeons never lay more than **two eggs for each sitting,** and rear **many pairs** in a **single year.**	,,	(3) *Contrast* with fowls—the **hen** sits on about **a dozen eggs,** and seldom rears more than **one brood a year.**
(4) The **young** are nearly always **a cock and a hen.**	,,	(4) There is no such **balance in the broods** of other birds.
(5) A **young pigeon** (called a Squab) is a bare, ugly, **miserable-looking object,** which lives **without food for three days,** if kept perfectly **warm** under the parent's wings.	,,	(5) *Contrast* this picture of **utter helplessness** with the **precocity** of a newly-hatched **chicken,** ready and able to feed itself as soon as hatched.
(6) The old bird then **feeds her young** with a **milky curd,** which she can bring up into her mouth, and pour into the beaks of her young ones.	,,	(6) *Contrast* with a young **sparrow,** to whom it is **only** necessary for the old birds to **bring the food**—not to prepare any special food.
(7) After **nine days** the young are **fed with softened grain** from the crop of the old bird.	,,	(7) *Note* the **gradations** or stages in these **feeding operations.**

PIGEONS—*Continued*

Objects.—Live Specimen in a Cage; Pictures of Various Breeds of Pigeons; a Fowl's Foot and Beak.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(8) The young then **peck for themselves,** and so mature.	Telling.	(8) Pigeons **breed fast** and **mature** (come to full growth) very **fast.**
(9) Pigeons **live in pairs** and **mate for life.**	,,	(9) *Contrast* with **fowls,** which **live in flocks;** and flocks are often parted **without disturbing the family** relationships.
STAGE V.—Uses.		
(1) Pigeons are **mainly** kept as **pets.**	,,	(1) *Say* that there can be no pets nicer or prettier **for children:** That **doves** are symbols [patterns] of **gentleness and affection:** That pigeons, like doves, utter the same **loving "coo,"** always a pleasant and soothing cry.
(2) Carrier pigeons are **trained to carry messages,** especially for newspaper and war purposes.	,,	(2) Messages are **reduced to smallest compass**—best **tied to the middle quill** of the tail.
(3) Pigeons are **used as food.**	,,	(3) When **eaten,** they may be **classed as poultry.**

Review by Recapitulatory Questioning on Salient Points in Each Stage.

XI.—THE DUCK

Objects.—Picture of Duck, or Living Specimen in Wicker Cage; a prepared Duck's Beak and Foot; Egg.

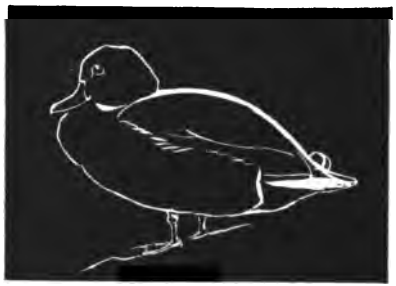
MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture or Specimen.		
(1) A duck is a bird about the **size of a fowl.**	Observation.	(1) If a living specimen is exhibited, allow *children to feel* the plumage, particularly its **thickness** on the **breast.**

(2) It is **unlike a fowl** in— (*a*) Having a flat **rounded beak** (yellow). (*b*) **Webbed feet** (yellow). (*c*) Very **small tail.**	,,	(2) *Point out* these parts—note the **difficulty** of discovering a **tail.** *Count* four toes, and *feel* texture of the two **web-pieces** joining the three long ones **in front.** *Feel* beak to *note* its round end and **spoon-like shape,** with **comb-like fringes**: also that it is softer and **not so horny** as that of the fowl.
STAGE II.—Questioning on Foregoing Examination.		
(1) The duck is a **swimming bird.** A Duck's Foot.	Questioning.	(1) For what **purpose** does the duck require its **feet webbed ?**—(For swimming.) When a bird lives much on the water, **which kind of beak** will be most useful to it—one which is **pointed** for pecking, or one which is **spoon-shaped for skimming ?**—(Spoon-shaped.) From the **shape** of the beak and its (comparative) **softness,** will the duck prefer hard grain or **softer food ?**—(Softer food—as worms, water-weeds, meal paste.) Is **water** warm or **cold to the touch ?**—(Cold.) What **kind of a coat** will a bird need **to live much upon the water ?**—(A thick warm covering.)
(2) The **plumage** is **thick,** and **varies** in **colour.**	,,	(2) Do ducks **differ** in **both shape and colour,** as fowls do?—(Not in shape, only in colour.) **What colours** do we notice among ducks?—(Many white ; others grey, brown, &c.) **What colour** are the **feet,** always?—(Yellow.) (*Note* that the **wild duck** has always **black feet.**) Which is the **better shape** for a **water bird,** a **compact** and tailless form, or one with a long tail to draggle in **water and mud ?**—(Tailless.) *Compare* with shape of a boat.
STAGE III.—Habits and Characteristics.		
(1) Unlike fowls, ducks **heed neither rain nor cold.**	Experiments and Telling.	(1) If a living specimen be used, **dash some cold water upon it** to show (1) that the bird does **not object,** and (2) that the **plumage** quickly **dries** (there is so much **natural oil** in the feathers).

THE DUCK—*Continued*

Objects.—Picture of Duck, or Living Specimen in Wicker Cage; a prepared Duck's Beak and Foot; Egg.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		Deduce that while fowls came from the warmer regions, **ducks** came **from the colder regions.** *Draw attention* to thickness of the soft downy **feathers on the breast,** where the body **comes in contact with the cold water** in swimming.
(2) **Ducklings take to the water** from the first.	Telling.	(2) *Adduce* this as **evidence** of the creature's **hardihood.**
(3) A duck has a **sensitive tongue** inside a **filter-like beak.**	Observation.	(3) *Exhibit* a prepared duck's beak *to show* the comb-like **fringes** round the outside of the **under half,** and the **corresponding ridges** of the **upper part** which fit on the other part to make a **kind of strainer.**
 A Duck's Bill.		*Illustrate* how when the duck has **dredged** up a mouthful, the water is quickly **drained off** through this strainer; and then the sensitive **tongue selects** the **eatable bits** by feel, and rejects the waste. [not available. *Illustrate* by making **a strainer** of a tooth-comb if a duck's bill be
STAGE IV.—Treatment and Uses. (1) Ducks need **space to range,** and **water to swim** upon.	Telling.	(1) *Discover* that a duck's **natural food** consists of worms, slugs, insects, water-plants.


Outline of a Duck.

	,,	*Tell* that in domestic state ducks are **not dainty feeders**, and may be fed on animal or vegetable food made up into **a soft paste.**
(2) The **flesh** of the duck is **wholesome, but rich.**	,,	(2) *Say* that it is so **savoury** when roasted, that **no** cook ever **attempts to boil it.**
(3) Duck **eggs** are good, but slightly stronger in flavour than those of the hen.	,,	(3) *Exhibit* specimen. *Note* larger **size**, and greenish **tint** of shell.
(4) The **feathers and down** are used for **bedding.**	,,	(4) *Note* **superior quantity and quality** obtained from breasts of swimming birds—soft and downy.

Review by Recapitulatory Questioning on Salient Points in Each Stage.

XII.—THE GOOSE

Objects.—Pictures of Goose and Duck (same scale, for comparative purposes); Down Feathers; Quill Pens; Fishing-float; a "Feathered" Arrow; Egg.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture.		
(1) The goose is a bird **like** the **duck, but larger.**	Observation.	(1) *Compare* shape, feet, beak, and other **details**, *reviewing this part of the Lesson* on the duck. Contrast size.
(2) Geese are either **white or grey.**	,, Telling.	(2) *Contrast* with **duck,** whose **colours vary.** The male bird, called a **gander,** is **nearly always white.**
(3) **Products** of the goose are **feathers, quills, eggs.**	Observation.	(3) *Pass* these objects *round* for examination.
STAGE II.—Questioning on Foregoing Examination.		
(1) The goose is a **large swimming bird,** with **webbed feet, rounded bill,** and **compact shape.**	Questioning.	(1) What **kind of feet** has the goose?—(Webbed.) [bird.) What **kind of a bird** do they show the goose to be?—(Swimming **Why** has it **a rounded bill?**—(For spooning soft food, and draining away the water.)

Objects.—Pictures of Goose and Duck (same scale, for comparative purposes); Down Feathers; Quill Pens; Fishing-float; a "Feathered" Arrow; Egg.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) The **plumage** is **thick** and **cleanly.**	Comparison. Questioning.	**Why** have these swimming birds **scarcely any tail?**—(So that they may not become draggled in mud and water, as the beautiful tail feathers of a cock would be.) *Compare* **shape** of goose with that of a **boat.** (2) What **kind of plumage** [a covering of feathers] will birds need, which swim at **all seasons,** cold weather included?—(A warm thick one.) Is the plumage **likely to be clean** or otherwise, with **so much water?**—(Clean.)
STAGE III.—Habits and Treatment. (1) **Wild geese** visit English lakes and marshes in **winter time**	Telling.	(1) These come **from the cold north** during **severe season:** they are therefore **birds of passage** (migratory birds). *Compare* with some of **our small birds** which also **go to warmer regions** in the winter. *Then contrast*—some **come to us** and some **leave us**—each **claims** that region as its **home** in which it **nests and rears its young** during the warmer season.
(2) Geese like to **live in flocks.**	,,	(2) **Wild geese fly in flocks,** in a V-shape, when migrating. Tame geese **thrive better in flocks.**
(3) Tame geese should be **kept near water.**	,,	(3) *Prove* the **advisability** of this by the **structure and habits** of the bird. *Name* rivers, lakes, and ponds **as suitable neighbourhood**—as in Fen district of England.
(4) The domestic goose **eats** clover, grasses, and other **herbage**; and is **fond of ranging** freely over commons, stubble fields, and other grass lands.	,,	(4) *Discover* that **nests** are always **on land,** and therefore pens must be. *Recommend* much **freedom,** and as wide a range over the land as possible—the **birds are happier** and do much towards **finding their own living** under these conditions. [**water.** *Contrast* with the **swan,** which lives almost **entirely on the**

STAGE IV.—Characteristics.		
(1) The goose is **not a silly bird,** as is often supposed.	Questioning.	(1) For which **purpose,** swimming or walking, do all these swimming birds, as ducks, geese, and swans, seem to have their **legs and feet specially formed**?—(Swimming.)
	Memory.	**Which** do they perform **gracefully,** and which **awkwardly**? —(Swim gracefully, walk awkwardly.)
	Telling.	*Show* that the legs are short, and **set far back** on the body, which is the cause of the **waddling gait.**
		Surmise that it is its awkward **waddling walk** which has attached the **idea of silliness** to the goose.
(2) It has sometimes shown **intelligence, bravery,** and **faithful affection.**	,,	(2) *Instances may be given* of the goose attaching itself to individuals and following with the **fidelity of a dog**; of **facing a marauding fox** with brave and defiant hiss, &c.
STAGE V.—Uses.		
(1) The **flesh** of the goose is **good, rich, and savoury.**	Memory.	(1) *Seek these qualities* from personal *previous knowledge* of a "Christmas goose."
	Telling.	*Prefer* the "Michaelmas goose" for **delicacy of flavour**; it is **fed naturally** in the stubble fields, and not specially fattened for market.
(2) The **feathers and down** are excellent for **stuffing** beds, pillows, and cushions.	,,	(2) *Rank* **goose feathers before those** of duck, and far before those of fowl.
		Show that their **downy softness accompanies the great thickness** of plumage on the breast of this large swimming bird, whereby it is **incommoded by the coldness** of freezing water.

Outline of a Goose.

THE GOOSE—*Continued*

Objects.—Pictures of Goose and Duck (same scale, for comparative purposes); Down Feathers; Quill Pens; Fishing-float; a "Feathered" Arrow; Egg.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) Goose **quills are used** for pens, tooth-picks, and floats; and for feathering arrows.	Telling.	(3) *Acknowledge* our great indebtedness to the goose, whose quills provided **a writing implement** for the preservation of learning centuries before the steel pen was invented.
	Experiments.	*Cut a quill pen* with a pen-knife, and derive the name of "pen"-knife.
	,,	*Exhibit* a "grey goose shaft" and contrast its **straight flight,** with the whirling flight of a feathered shuttlecock.

Review by Recapitulatory Questioning to bring out the Salient Points in Each Stage.

XIII.—THE RABBIT

Objects.—A Live Specimen in a Basket lined with hay; Prepared Jaw-bones of Rabbit; Felt Cap.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Living Rabbit.		
(1) The rabbit is a **gentle creature,** about the **size of a cat.**	Observation.	(1) *Note* **timid mien**; and mild, though prominent, eyes.
(2) It is covered with **soft fur—colours varying** in **tame** rabbits.	,,	(2) *Let* fur be **stroked.** *Note* that **wild rabbits** are generally **greyish-brown,** underparts greyish-white.
(3) Its **ears are long,** and often "lop" or hang down in tame breeds.	,,	(3) *Suggest* that **erect ears** of wild rabbits mean that the timid creatures **have constantly to listen** for approaching danger.

(4) Its **hind legs are stronger** than its fore legs: the **toes are strong.**	,,	(4) *Compare* fore and hind legs as to length and thickness of **thighs.** *Feel* **strength of nails,** and *count* four on each foot.
(5) Its front **teeth** are **sharp** and **chisel-shaped.**	,,	(5) *Feel* the teeth, and *note* their length and **chisel-edge.** *Count* two front **cutting teeth** in each jaw. *Note* **grinders** at back of jaws. *Note* that **front** of the cutting teeth is **hard enamel,** and that **underside is of softer material.**
STAGE II.—Questioning on Foregoing Examination.		
(1) The **wild rabbit** lives on **dry sandy soils.**	Questioning.	(1) To **keep** such nice **fur clean,** will the rabbit need to live on soil which is **dry,** or on soil that is **muddy?**—(Dry soil.) What is the nicest and **lightest soil** you know? that lets the **water drain through it** and **dries very soon?**—(Sand.)
(2) Its **fur** is near the **colour of sandy soil,** which **protects it** from being seen too readily.	,,	(2) If the rabbit is timid, and wishes **to escape being seen,** should it **live on a soil that is like,** or unlike its fur **in colour?**—(On a soil near the colour of its fur.)
(3) The rabbit **burrows in the ground.**	,,	(3) Where does the timid **mouse hide from danger?**—(In holes.) If the timid rabbit lives in the **open air,** and wants to hide **in holes,** will it be hard or **easy** to make holes **in the loose sand?**—(Easy.) **Why** is the rabbit provided with **strong claws?**—(For scratching holes in the ground.)
(4) The rabbit is a **gnawing animal.**	,,	(4) Were the **sharp-edged** front **teeth** of the rabbit **for cutting** or for grinding?—(Cutting.) What do we call the action of **biting a thing away bit by bit?**—(Gnawing.) Then what kind of an animal **might we call the rabbit?**—(A **gnawing animal.**)
STAGE III.—Structure and Habits.		
(1) Rabbits **live** together **in large companies.**	Telling.	(1) *Describe* a **colony of rabbits** coming out to **feed** in the **evening.**
(2) The place where they burrow is called **a warren.**	,,	(2) *Describe* a rabbit hole—a run to a **living chamber,** and a **back exit** for escape.
(3) They **feed** on tender **grass** and the **juicy bark** of young trees.	,,	(3) *Note* that while they generally select something **juicy,** they can **gnaw hard substances** to keep teeth in order.

THE RABBIT—*Continued*

Objects.—A Live Specimen in a Basket lined with hay; Prepared Jaw-bones of Rabbit; Felt Cap.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(4) Their front gnawing teeth **wear away** at the sharp **tips**, but **grow equally fast at the roots.**	Telling.	(4) *Compare* with a chisel which **wears away on the grindstone,** yet keeps **sharp at same time.** *Account* for maintenance of **sharp cutting-edge** by the softer **underside wearing away** more rapidly **than the hard enamel** on the front. *Inform* children that the front **cutting teeth of all rodents are constantly growing,** and that the **cutting-edge is kept** on them in a similar way **by habitual gnawing.** *Examine* **roots** of the teeth in the prepared jaw-bone.
(5) The rabbit is a **timid** creature, and **seeks safety** by **flight and hiding.**	,,	(5) The rabbit can **run fast** for **short distances only**, and **needs the shelter** afforded by **its burrow** in the end.
(6) The rabbit **can turn very quickly** when **running at full speed,** to escape capture.	,,	(6) *Explain* superior **strength of hind legs**, which enables the flying creature to **turn suddenly** at right angles **when its pursuer is just about to snap** at it.
(7) The **white tail** seems to serve as a **danger signal** to the others behind it.	,,	(7) *Show* that the little tail is black above, while the **underpart is white,** and is always the **last thing seen** as the creature **bolts into its hole** at any alarm.
(8) The **defenceless timidity** of the creature is **shown** by the **large ears and prominent eyes.**	Questioning.	(8) Who are likely **to escape danger,** those who are blind and deaf, or those who **can see and hear well?**—(Those of keen scent and quick eyes.)

A Rabbit's Mouth.

STAGE IV. — Treatment of Tame Rabbits.		
(1) A rabbit **hutch** should be **large and airy.**	Telling.	(1) *Demand* these for ventilation, cleanliness, and exercise. *Suggest* periodical **white-washing.**
(2) Besides the **day run,** there should be a **smaller dark room** for sleeping.	,,	(2) *Compare* this to **dark hole** of the **burrow.** *Suggest* wire-work or perforation for **ventilation.**
(3) **Dry and clean beds** should be regularly provided.	,,	(3) *Name* hay and straw as best kind of **bedding** if regularly **changed,** and kept **dry and clean.**
(4) Rabbits should be **fed regularly** and on a **mixed diet.**	,,	(4) *Warn* that too much **green food** is **often fatal**; *recommend* oats and roots in **morning,** roots and green food at **mid-day,** and meal or mash at **night**; when green food is scarce a little milk and water to **drink** is useful.
STAGE V.—Uses of the Wild Rabbit.		
(1) The **flesh** is a **delicate and wholesome food.**	Memory.	(1) *Recall* the various **ways of cooking** rabbits: that rabbits are **plentiful and cheap.** *Claim* that the flesh is as **delicate** as that of **poultry,** which is much **dearer.**
(2) The **fur** is used for **lining** cloaks, for cheap muffs, &c.; and also for making **felt hats.**	Questioning.	(2) Which **fur** is the more **difficult to obtain,** that of the rabbit, or that of scarcer **wild animals** which live in **far-off lands?**—(Furs of scarcer animals.)
	Telling.	If rabbit skins are **plentiful,** will they be **cheap** or costly?—(Cheap.) The **hair removed from the skin** is beaten up in a sticky substance till it is all **matted together**; it is **pressed** into shape for making felt hats. *Exhibit* some **felt.**

Outline of a Rabbit.

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.

XIV.—THE HARE

Objects.—Picture of Hare and Wild Rabbit (same scale, for comparison); Prepared Jaw-bone of Hare, Rabbit, or other Rodent; a piece of Felt.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture of Hare.		
(1) The hare is **like the rabbit, but** rather **larger.**	Observation.	(1) *Note* that *in comparison* the size of hare not only exceeds that of rabbit generally, but **proportionately** that the **head** is **longer,** as are also the **tail, ears,** and **hind legs.**
(2) The **colour differs** slightly, the hare's coat being **dark brown,** with a **white breast,** and **black tips** to the **ears.**	,,	(2) *Distinguish* between the **brown tints** of hare, and the **grey tints** of rabbit. *Show* that the former **tends** to warm **yellows and reds.**
(3) The **hind legs** are **more powerful** than the fore legs.	,,	(3) *Compare* with rabbit in this respect.
STAGE II.—Questioning on Foregoing Examination.		
(1) The hare is able to **run swiftly** for a **long distance.** A Hare's Foot.	Questioning.	(1) **Which** animal seems the **stronger,** and the more able to **run farther?**—(Hare.) If the hare's **legs are longer,** may we expect it to be **swifter** or slower?—(Swifter.)
(2) Its strong **hind legs** enable it to **turn sharply** when running **at full speed.**	,,	(2) When a **boy** is being **chased,** does he run straight or **turn aside when nearly caught?**—(Turns.) **How** do rabbits and hares often **escape capture** by dogs?—(By turning aside.) Outline of a Hare.

		What enables them to turn more sharply than their **pursuers**?—(Strength of hind legs.) **What shelters and saves** the rabbit in the end?—(**His burrow.**)
(3) The hare makes its home or nest (called a **form**) amidst a cluster of tall grasses and other **plants** whose **brownish tints** being similar to its own coat **afford it protection** from the **eyes of its enemies.**	,,	(3) **What colours** do leaves, grasses, ferns, and other green **plants turn** in the autumn **when they begin to dry up?**—(Yellow, red, brown.) If you had to live in a field, would you **choose** the green growing plants to lie upon, or the **dried up and brown plants?**—(Dry and brown coloured plants.) Suppose a **brown hare** were lying in tall **brown dry grass** and ferns, would it be easy or **difficult to see him?**—(Difficult.) If the **hare** possesses **no such protection** as the **burrow** affords the weaker rabbit, **which** should be **able to endure the longer** chase?—(The hare.)
STAGE III.—Structure and Habits.		
(1) The hare **lives a solitary life,** and not in large companies, as the rabbit does.	Telling.	(1) *After referring* to the large **colonies** of rabbits living together in a **warren,** *tell* that the hare lives a **solitary** life in the **open.**
(2) Its **form or nest** is made simply by **pressing down the grass** and other herbage.	,,	(2) *Contrast* with the scratching and **burrowing habits** of the rabbit. *Show* that a **poorer hiding-place** necessitates **greater vigilance**—the hare being the **most watchful** of all the timid animals.
(3) The hare is **clever at dodging** its pursuers.	,,	(3) *Show* how **cunning** is bred by its **defencelessness.** *Demonstrate by a few lines on B.B.* how the hare escapes its pursuers:— (*a*) By turning sharply while the **hound overshoots itself,** and so loses ground. (*b*) By running straight as long as it is in sight, and then "**doubling**" **back.** (*c*) By making several **great bounds** to break the scent, and then **going off in another direction.**
(4) Its **teeth** are made **for gnawing,** like those of the rabbit.	,,	(4) *Review* the **teeth formation** of the rabbit, and *compare.*
(5) The hare **comes out in the evening,** and on a moonlight night may be seen **frisking merrily** about.	,,	(5) *Admire* the **disposition** of the hare—**timid,** defenceless, and **surrounded by enemies,** yet withal nimbly **playful** when rejoicing in its freedom.

THE HARE—*Continued*

Objects.—Picture of Hare and Wild Rabbit (same scale, for comparison); Prepared Jaw-bone of Hare, Rabbit, or other Rodent; a piece of Felt.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE IV.—Uses.		
(1) The **flesh** is dark-coloured, and makes a **savoury** food.	Telling.	(1) *Contrast* with **light-coloured** flesh of **rabbit.**
(2) The hare is **hunted for its flesh.**	,,	(2) *Name* various ways—(*a*) **coursing** with dogs; (*b*) **shooting**; or (*c*) catching in **traps.** *Designate* **food** which has to be **hunted** as "**game.**" *Classify* hares and rabbits as "**ground game,**" as distinguished from birds or "**feathered game.**" *Allude* to duties of **gamekeepers.**
(3) The fur is used for **linings** of winter garments, or for making **felt.**	,,	(3) *Recall* the same **uses** made of rabbit skins.
(4) Hares have **rarely** been **tamed as pets.**	,,	(4) *Recommend* the **free life** as **best suited** to the habits and temperament of the hare. *Mention* that the poet **Cowper overcame the shyness** of these creatures and kept some running about his house as **tame pets.**

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.

XV.—DEER

Objects.—Pictures of Red Deer, Fallow Deer, and Roe Deer (all to same scale). Antlers, Buckhorn Handles, Buckskin Glove.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictures. (1) Deer are **graceful**-looking **creatures**—bodies **slim**, covered with yellowish red and brown **fur**; four **slender legs** end in **cloven hoofs**; **tail short**, and **head tapering** to a **square muzzle**; **eyes** large and **full**; **ears** point out **sideways**.	Observation.	(1) *Point out* all the **common features** first— All appear to be **constructed for speed.** ,, possess the **gentle** disposition of **grass-eaters.** ,, ,, **heads like** those of **cows**, but **less heavy**-looking. ,, ,, a **mild expression** rather than a fierce one. *Pass round* a piece of **buckskin** to be felt, and if possible a piece of **hide with the hair on it.**
(2) There are various **kinds** of deer (three being shown in the pictures)— (*a*) The **largest** of these is **darker** on the **ridge of the back**, and is **lighter on hind quarters.** (*b*) The **second** in size has its brown fur **dappled** with white. (*c*) A third in size has no vestige of a tail and its coat is **uniform "fawn" brown.**	,,	(2) *Explain* that there are **many kinds** of deer, but these **three belong to British Isles.** (*a*) *Compare* **size** with that of a well-grown **calf.** The **names** *may be given* at this stage—**red deer,** the largest of all our wild animals. (*b*) Name this the **fallow deer.** (*c*) Name this as the **roe**, and *compare* size with that of a **goat.**
(3) **Some** of them **have horns**— (*a*) Those of the **largest kind branching to many points.** (*b*) Those of the **next** having a **broad, flat, palm-like piece.** (*c*) Those of the **smallest** being very **simple**; they are **straight** for greater part of length, and **fork** into **two branches at the top.**	,,	(3) *Pass round* for examination **antler**, and specimens of horn. *Let it be noted that*—the **substance** is **bone-like**, it is **solid**, it is **veined** by indented lines, } while a **cow's** horn { is similar to its **hoof.** is **hollow.** is **very smooth.** If the horn be a complete one, let the **kind of deer** from which it came be **identified** on the picture.

DEER—*Continued*

Objects.—Pictures of Red Deer, Fallow Deer, and Roe Deer (all to same scale). Antlers, Buckhorn Handles, Buckskin Glove.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE II.—Questioning on Foregoing Examination. (1) Deer are **grass-eating animals.** (2) They are **shy and fleet** of foot to fly from danger. (3) There are **many kinds of deer,** three of them being found in these islands. (4) The **males** have **horns.**	Questioning.	(1) Why may we **judge them to be grass-eaters** and not flesh-eaters?—(Gentle and shy look.) (2) **What** would make us **think that deer are swift** runners?—(Slim body and slender legs.) (3) *Let class name* the three sorts, and at same time *point them out* on wall pictures. (4) **Which** are the **stronger,** men or women? Which **go as soldiers and sailors** to fight our battles?—(Men.) **What fighting weapon** have some of these **deer?**—(Horns.) **Which** do you think **have horns,** male deer or female deer?—(**Male deer.**)
STAGE III.—Structure and Habits. (1) Deer are **cud-chewers,** and **graze like sheep.** (2) Deer are **wild animals,** living in quiet and **lonely parts** of the country. (3) (*a*) **The red deer** are found in Scotland, but only in **one part of England** (the wilds of Exmoor). (*b*) **Fallow deer** are more than **half-tame,** and are **kept** in gentlemen's parks **for ornament.** (*c*) **The roe,** smallest of the British group, is now **found only in Scotland,** though once plentiful in England.	Telling. ,, ,,	(1) *Compare* with **domestic ruminants,** as cow, sheep, goat—*noting* their **shyness.** (2) *Remind* that we **seldom see** these creatures, although they **are to be found** without leaving our own land. (3) *Have each kind pointed out* while they are being *commented upon.* **Name** a family group of— (*a*) **Red deer** as **stag** (or **hart**), **hind,** (*b*) **Fallow deer** as **buck, doe,** } and **fawn.** (*c*) **Roe deer** as ,, ,, *Speak generally* of a buck, and a roe-buck as *a sufficient distinction* in the two last named.

(4) (*a*) The two **larger kinds** live in **herds.**

(*b*) The **roe-buck** attaches himself to **one mate,** and they are content to **live by themselves** in thickets of young wood.

(5) Stags (and bucks) **renew their horns every year,** shedding them in the early spring.

Outline of a Deer.

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(4) *Note* that **all** are **shy,** and possess an **acute sense of smell,** so that they are **difficult of approach.**

Describe the **noble stag,** with his **ruff of thick fur and fine head,** how he **leads the herd,** and will even **turn to bay** when wounded.

(5) *Trace briefly this process of rapid growth*—(*a*) horns **shed about February;** (*b*) in a week **velvety skin** covers the **two scars;** (*c*) **protuberances** [lumps] appear beneath and **begin to grow;** (*d*) **in ten weeks** the horns are **replaced;** (*e*) the **skin tightens round the burr** at the base, **blood vessels are thus shut off,** and the **skin** dries and **peels off.**

Exhibit the **vein-marks** which always remain on the antlers, and *point out* the **burr.**

Note that **antlers develop gradually;** (*a*) the **first year** the animal has **no horns;** (*b*) in **second year two straight points** appear; (*c*) one or two points are **added each year,** irregularly; (*d*) the **points or tines** seldom exceed **ten or twelve,** and all have **special names** among hunters, commencing with **brow antlers,** and going upwards.

Omit these detailed particulars with the lowest Standards, for whom it may suffice to have the **shedding and renewal** of these **osseous horns** contrasted with the **permanent horns** of **cows** and **goats.**

STAGE IV.—Uses.

(1) The flesh, called **venison,** is **excellent food.**

(2) **Buckskin** is a useful kind of **soft leather,** used for gloves and similar purposes.

Telling.

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(1) *Gather* that venison is **high-priced** because it is **scarce;** and is **lean** rather than fat, because animal is formed for speed.

(2) *Name* gloves, gaiters, purses, &c., **made of buckskin,** and *show* any available *examples.*

DEER—*Continued*

Objects.—Pictures of Red Deer, Fallow Deer, and Roe Deer (all to same scale). Antlers, Buckhorn Handles, Buckskin Glove.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) **Horns** make excellent **handles.**		(3) *Name* handles of knives, steels, &c., and *exhibit* any available *examples.*
(4) **Fallow deer** are kept for **ornamental purposes.**	Telling.	(4) *Illustrate* by a picture of any **lordly domain** animated by the **presence of deer.**
(5) **Hunting the stag** was once a **royal sport** in England.	,,	(5) *Allude briefly* to the penal **forest laws of ancient times**, and *show* that with the **increase of population** lonely **forest homes** suitable for such wild creatures **must become scarcer.**

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.

XVI.—THE FOX

Objects.—Picture of Fox; Pictures of Dogs.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture. (1) The fox is an animal **something like a dog,** but (*a*) Its **nose,** or **muzzle,** is **more pointed.** (*b*) Its **tail** is **longer** and more **bushy.** (*c*) Its **ears** are **three-cornered** instead of being rounded.	Observation.	(1) *Point* to **each** of these **structural points** in turn, and the **differences** (*a*), (*b*), and (*c*) *may possibly be elicited by questioning.*

(*d*) Its **eyes** are more **like those** of a **cat.**	Telling.	(*d*) **This difference** will probably not be apparent from a picture, but may be *mentioned here for convenience*, or withheld till Stage III. is reached.
(2) Its **fur** is mainly **light-brown** in colour, and rather **thick.**	Observation.	(2) The *children* may easily *point out* "the white parts" and "the black parts," but such *terms* as "hindquarters" and "ashen colour" will have to be *provided for them.*
(*a*) The **feet** and **ear-tips** are **black.**		
(*b*) The **shoulders** and **hind-quarters** have an **ashen tinge.**		
(*c*) The **cheeks, throat,** and **tail-tip** are **white.**		*Bring out* that the **actual size** of the fox is **deceptive,** owing to the **thickness** of its covering of **fur.**
STAGE II.—Questioning on Foregoing Examination.		
(1) The fox is **an English wild animal.**	Questioning.	(1) If the fox is an English animal, **why do we not see it** about, as we do the dog?—(It is wild.) If it is a **wild animal,** may we expect to find it near towns, or in **lonely country districts?**—(In lonely country.)
(2) It is the **largest of our wild flesh-eaters** and beasts of prey.	,,	(2) If it is **like the dog,** especially in its **teeth,** what **kind of food** will it eat?—(Flesh food.) If the fox is a **wild** creature and **eats flesh, how** will it be obliged to **get its food?**—(By preying.) If it is only of the **size of a small dog,** will it be able to attack and **kill** large or **small animals?**—(Small.)
(3) It is a sharp and **cunning animal.**	,,	(3) By the **sharp muzzle, pointed ears,** and **keen** set of the **eyes,** should we judge the fox to be a **sharp,** or a slow and dull **animal?**—(A sharp animal.) If the fox has to **hunt its own prey,** and also to **avoid** the sharp teeth of **big dogs,** will its **character be sharp and cunning,** or dull and stupid?—(Sharp and cunning.)
STAGE III.—Structure and Habits.		
(1) The fox has **eyes** which **adjust themselves** to the amount of **light,** as the eyes of a cat do.	Memory.	(1) *Recall* the lesson on the **cat,** and refresh memories on the **structure of** this kind of **eye.** *Gather* that its chief **use** was to enable the creature **to see at night-time** in very little light.

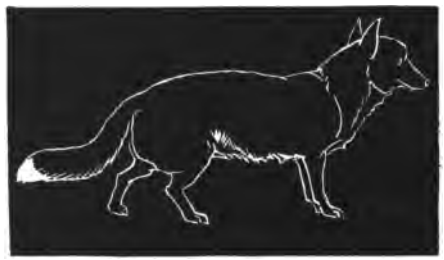
THE FOX—*Continued*

Objects.—Picture of Fox; Pictures of Dogs.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) The fox is a **night hunter,** and is destructive of **poultry** and **game;** he will sometimes attack a sheep.	Questioning.	(2) If the fox possesses **eyes of this kind,** when will he be **able to hunt** his prey?—(**Night-time.**) When are most **animals easier to catch,** in broad daylight or **sleepy night-time**?—(Night-time.) *Class to name* some large **wild fowl** (pheasants, partridges) and **ground game** (hares and rabbits). Suppose these **wild creatures** near his own woods **fail the fox,** what can he **steal from** the **farmyard**?—(Chickens, ducks, geese—and sometimes even a sheep will be worried.
(3) The fox will sometimes **eat eggs, mice, frogs, and snails.**	Telling.	(3) *Suggest* stress of weather, watchfulness of farm dogs, and other **circumstances driving fox to these extremes.**
(4) The fox digs **deep burrows** in the earth to pass the **daytime under ground.**	,,	(4) *Describe* "**fox's earth**"—(*a*) **two openings** to permit of escape; (*b*) divided into **three parts,** one for living, one for sleeping, and one for a storehouse.
(5) Its **legs** are **strong** for **running** as well as for **scratching.**	,,	(5) *Lead* from its **scratching habit** to its powers of **endurance in the chase.**
(6) The **tail** is called the **brush.**	,,	(6) *Name* the brush as the **reward** of the **first up at the "death"** in a fox-hunt—no other part valued.
STAGE IV.—Characteristics. **(1) Cunning and craftiness** distinguish the fox, and he is full of tricks.	Telling.	(1) *Argue* that having **to catch** other animals as **prey,** and **to avoid** the deadly enmity of **watchful dogs,** whilst its **small body cannot contain great muscular power** (as in the large body of a lion), the fox has to **make out for lack of strength** by **depth of craft.** *Enumerate* **some tricks,** as (*a*) waylaying a victim; (*b*) stealthy midnight prowlings; (*c*) jumping sideways and doubling back to throw hounds off the scent when being hunted; (*d*) running amongst a flock of sheep to disguise his own scent amongst theirs, when hounds are close upon him.

(2) The fox emits a **disagreeable odour.**	,,	(2) *Lead up* to this from previous step.
(3) He is **accounted vermin.**	,,	(3) *Challenge* any child to **find a use** for the fox—*classify* it therefore among the **useless and disagreeable animals** usually designated "vermin."
(4) Yet is **preserved** (or kept from wholesale destruction) **by rich landowners.**	,,	(4) *Inform* children that some landowners **do not like foxes killed** by farmers and others, but would **rather pay for the poultry** which any foxes from their woods may steal. *State* that their object is to **preserve the fox as a wild animal** that they may have the "sport" of **hunting** it to death. *Briefly describe* a **fox-hunt**; and show that in a thickly populated country like ours **hunting is difficult to obtain,** owing to scarcity of wild animals.
(5) Foxes are **found in many parts** of the world.	,,	(5) *Instance* the **Arctic fox**, whose fur changes to almost white (blue-grey) in winter, and is very valuable as an article of clothing.
(6) The male is called a **dog fox,** the female a **vixen,** and the young ones **cubs.**	,,	(6) *Give these names.*

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.



Outline of a Fox.

XVII.—THE MOUSE

Objects.—A live Mouse (in wire cage). Pictures of Mice and Rats or other Rodents ; Jaw-bone (prepared) of Rabbit or other Rodent.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Living Specimen.		
(1) The mouse is amongst the **smallest of four-footed animals.**	Observation.	(1) *Pass round* the caged mouse, *using wall-chart* of Mouse to point out **parts** of structure **under inspection.**
(1) It is a nibbling or **gnawing animal.**	Experiment.	(2) *Give* mouse a bit of cheese **to nibble.** *Exhibit* **gnawing teeth** in prepared jaw-bone.
(3) Its **fur** is a very **dark grey, near to black.**	Observation.	(3) *Exercise* children **in finding a name for the colour**—admit difficulty of doing so by saying we speak of "mouse colour."
(4) It has **four toes** on each **fore-foot,** and **five on each hind-foot,** all armed with **claws.**	,,	(4) *Count* **toes**—*show* **claws.** *Note* that these members are **reversed on cat**—five on fore and four on hind foot.
(5) Its **tail** is **long, thin, and tapering,** and covered with very short hair.	,,	(5) *Touch* the **tail** to *test* its **sense of feeling.**
(6) It has **whiskers, large eyes** like beads, and large **upright ears.**	,,	(6) *Direct attention* to these in turn, and the **comparative largeness** of two latter features. *Note* that **eyes** are always **wide open.** *Show generally* that the mouse is **small and defenceless in form,** shy and **timid in manner.**
STAGE II.—Questioning on Foregoing Examination.		
(1) Mice are familiar **house vermin.**	Questioning.	(1) **Where** do mice **live?**—(Holes and corners of houses and other buildings.) Are they **bold** or shy and **timid?**—(Shy and timid.)

Outline of a Mouse.

		Are mice **useful** and welcome, or **troublesome** and disliked? —(Troublesome and disliked—vermin.)
(2) The **colour** of a mouse's **fur** enables it to **run about without detection** at night-time, or in dark places.	,,	(2) **Which colours** can be less readily seen in **dark places,** light ones, or dark ones?—(**Dark ones.**) Which will be better **for the safety of little creatures** that come out at **night,** and always prefer **dark places** to light ones?—(**A dark colour.**)
(3) Its **whiskers** are **feelers**; and it has the **sense of touch** reaching behind **to the end of its long tail.**	,,	(3) What has the mouse to enable it to **feel its way through dark holes** and crannies?—(Whiskers.) What has it behind to **feel the approach of danger from the rear**?—(Sensitive tail.)
(4) Its **large eyes and ears** show it to be a **watchful** little creature.	,,	(4) **What feature** shows it to be a **watchful creature**?—(Its large eyes.) What **other feature** makes it to be **keenly alive** to any **danger before it can be seen**?—(Large ears.)
(5) It makes **secret forays on our food stores,** and is therefore regarded as "**vermin.**"	,,	(5) What does it often do to **our food**?—(Eats it.) Is it welcome to **nibble our food,** or does it have to do so **stealthily**?—(Stealthily—secretly.) Then how do **we regard the mouse,** as a useful or a **useless creature**?—(Useless—vermin.)
(6) The mouse, being quite **defenceless, creeps** quickly and **noiselessly,** and is a **good climber.**	,,	(6) If the creature **has to hide** out of our way, **should it be** large or **small**?—(Small.) Noisy in its **movements,** or **noiseless**?—(Noiseless.) Slow or **quick**?—(Quick.) A **good** or a poor **climber**?—(A good climber.)
(7) The mouse is a **gnawing animal** (or **rodent).**	,,	(7) When the mouse is eating, **what teeth** can it be **always seen to use**?—(Front teeth.) What do we call this **eating away** of stuff bit by bit, or **nibbling**?—(Gnawing.)
STAGE III.—Structure and Habits. (1) The mouse has **front cutting teeth** with a chisel-like edge, the two upper ones playing freely over the two lower ones.	Comparison. Telling.	(1) *Compare* with those of **rabbit.** Examine **hard enamel** on the front, and **softer parts underneath.** Mice are known to **gnaw** through **floor-boards** and **lead pipes** with these strong teeth—a **useful power** to a creeping, hiding **little creature**; but **destructive** to man's **property.**

THE MOUSE—*Continued*

Objects.—A live Mouse (in wire cage). Pictures of Mice and Rats or other Rodents; Jaw-bone (prepared) of Rabbit or other Rodent.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) Being **objectionable to man,** the mouse has **night-prowling** habits, and **comes out** of its hiding-places when **all is quiet,** to make **secret attacks** on our food stores and other property.	Telling.	(2) *Associate* the **destructive powers** which make it so objectionable, with its **night-habits,** and its shy and **timid manner.**
(3) Its **size and form** are **suited to its mode of life**; for it has—	,,	(3) *Gather up* the points made in the previous stages, *recalling that*—
(*a*) A small, **slim,** wedge-shaped **body.**		(*a*) The **tapering head** is like the **point of a nail** or any other wedge made for entry to narrow spaces.
(*b*) A **quick sense of touch** in its whiskers and in its tail.		(*b*) The **whiskers gauge** for width of body that follows: the **tail** in frame-work is a **continuation of the back-bone,** but with **more movable joints,** and barely covered with hair that it may be more **sensitive to touch,** and so feel more readily the **approach of danger.**
(*c*) Quick **sharp eyes** and **sharp upright ears.**		(*c*) **Alertness** needs both sharp **eyesight** and quick **hearing**—**eyes** that can see well at night-time.
(*d*) A **dark-coloured fur.**		(*d*) The **colour and shortness of the fur** make it serviceable for a creature **living in dusty places.**
(*e*) **Climbing and gnawing powers.**		(*e*) **Combined** with noiseless creeping movements, these powers **enable** it to force its way through obstacles and to **climb** between **one level and another.**
STAGE IV.—Uses.		
(1) Mice are **generally harmless**; they are of **some use** in **eating up** small scraps and crumbs which might otherwise **decay** and **cause mischief.**	Telling.	(1) *Admit* that they are classed as vermin, and may become a nuisance, and even a **plague,** if **permitted to increase** to large numbers. *Show* that **crumbs** often **fall** where they **cannot be recovered** by us, but **mice being** very **small find their way** to such

		crevices, and **eat up these scraps** before they decay and make unpleasant smells. *Teach* that mice only **congregate where they find plenty of food** to eat, and to **rid** a place of them it is best to **cut off their supplies.**
(2) Mice provide **food for cats,** owls, and **other creatures of prey.**	,,	(2) *Allude casually* to the way **animals prey upon each other.** *Point out* the **difference** between **tame creatures fed by man** (as the cat) and **wild creatures** which **must find prey or perish.**

Review by Rapid Recapitulation to bring out Salient Points in Each Stage.

XVIII.—THE RAT

Objects.—A Live Rat in a Wire Cage, or a Dead Specimen. Pictures of Rats and Mice, and other Rodents; a Carpenter's Plane or Chisel.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Living Specimen, or of Pictures.		
(1) The rat is **like the mouse** in form, but **larger in size.**	Observation.	(1) *Compare* sizes of rat and mouse, and **more formidable aspect** of latter.
(2) It is another **gnawing animal.**	Experiment.	(2) *Tempt* rat with a bit of hard tallow or grain, *to notice* **how it uses** its four **front teeth.** *Compare* with the cutting of a chisel or a plane. *Pass round* the chisel or plane blade to note **sharp edge** of hard steel, and the softer iron at back **ground away.**
(3) It is **stronger** made than the mouse, but is much **like it in—** (*a*) The dark **colour** of the fur. (*b*) Its **short legs** with **hand-like paws,** armed with **strong claws.** (*c*) Its long **tapering tail.** (*d*) Its **whiskers,** its **sharp eyes and ears.**	Observation.	(3) *Argue* that **larger bulk** gives **greater strength,** when both are built on same plan. (*a*) *Observe* **browner shade** of the rat. (*b*) *Notice* **grasping** power, **scratching** power, and pliability of the **joints.** (*c*) *Contrast* coarse **bare look** of rat's **tail** with the prettiness of the mouse's. (*d*) *Contrast* with mouse—these **features** in the rat do **not** add to it **an air of timidity,** but rather the reverse.

THE RAT—*Continued*

Objects.—A Live Rat in a Wire Cage, or a Dead Specimen. Pictures of Rats and Mice, and other Rodents; a Carpenter's Plane or Chisel.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE II.—Questioning on Foregoing Examination.		
(1) The rat **differs from the mouse** in—	Questioning.	(1) *Proceed to discover* some differences between the rat and the mouse.
(*a*) Its **large** size and somewhat **fierce** look.		(*a*) Which is the **larger**?—(Rat.) Which has **a rather savage look**?—(Rat.)
(*b*) Its **tail** being comparatively **shorter, and bare.**		(*b*) Why does the **rat's tail** look **uglier** than that of the mouse?—(It is bare, and not so fine.)
(*c*) Its **fore-paw** having a **small thumb.**		(*c*) How many **toes** has the mouse on each **fore-foot**?—(Four.) But what do we notice **at the side of a rat's fore-foot**?—(Something like a small thumb.)
(*d*) Its **hind-paws** being so **loosely jointed** that they may be turned right round, enabling the rat to run head first down any rough surface.		(*d*) When rats and mice **are seen climbing,** as up and down the wires of a cage, what may be noticed about those **joints like our wrists**?—(That they work loosely and **allow the paws plenty of play.**)
	Memory or Telling.	Who has ever seen a rat **coming down a wall** or the trunk of a tree? How does it come down?—(**Head first,** clinging by the **hind claws turned backwards.**)
(2) The rat has the **same wedge-shaped body** as the mouse.	Questioning.	(2) **Is** there much or **little difference in height** between a standing or **running** rat, and one which is crouching **or sitting down**?—(Very little difference.) Does this show that **they have** long or **short legs**?—(Short.) **Why** do rats and mice **need short legs**?—(**For creeping** through crevices and crannies.) What else in **their form aids them** in creeping through **narrow spaces**?—(Slim **body,** and "gauging" **whiskers** on a pointed **snout.**) What do we **mean by** "**creeping**"?—(Moving along low down, almost on the belly.)

(3) The rat has the same kind of **strong front teeth,** which are **constantly growing.**

Rat's Paw (much enlarged).

,,

(3) What are **rats constantly** doing with their sharp cutting teeth? —(**Gnawing.**)

What happens to a **knife** whicl is being **constantly used** for cutting?—(**Wears away.**)

But if a rat's **teeth are always being used,** and **never** seem to **wear away,** and certainly **never wear shorter,** what must the teeth be doing as fast as they are worn away?—(They must be **growing just as fast.**)

Outline of a Rat.

Refer to hard **enamel** at front **(corresponding to steel** of cutting blade) and the softer part known as **dentine underneath** (corresponding to **the iron** in the cutting tool).

Then ask which **part** of tool **grinds away faster**?—(Iron.) And which **part of tooth wears** away the **sooner**?—(The soft underpart.) Leaving the front part as a sharp —— ?—(Edge.)

STAGE III.—Structure and Habits.

(1) The **structure** of the rat **agrees with its habits** in—

(*a*) **Size, form,** and **colour**—enabling it **to hide** from its many enemies.

(*b*) Its **senses** of **hearing, sight,** and **feeling**—all very **keen.**

(*c*) Its powers of **getting readily from one place to another** as its needs demand.

Questioning.

Telling.

Questioning.

,,

(1) These points *may be gathered up again* from a review of previous stages—

(*a*) *Take* these three points *seriatim.*

Number men and dogs among the **rat's chief enemies**—then cats, foxes, weasels, &c.

(*b*) *Add to previous knowledge* that both **rats and mice** have the **power of seeing** as much as cats do in **dark recesses,** or at night **time.**

How do mice **find their way** to where **food is stored** in pantries, or rats to where stores are kept in barns and warehouses?—(**By scent**—hence our use of bait with strong smell.)

(*c*) *Review* its **modes of movement**—its **noiseless** creeping, its **climbing,** its **squeezing** through small apertures, its **gnawing through** partitions—all its wonderful powers of **silent entry** to any place to which it is **attracted by smell of food.**

THE RAT—*Continued*

Objects.—A Live Rat in a Wire Cage, or a Dead Specimen. Pictures of Rats and Mice, and other Rodents; a Carpenter's Plane or Chisel.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*d*) Its **fur** coat is **warm** for its **nocturnal prowlings.**	Questioning.	(*d*) Why have rats and mice **peculiarly strong eyes?**—(To see well in little light.) Why do they **not come out boldly** to feed in broad daylight?—(**So many foes.**) Why are **men the enemies** of rats and mice?—(They eat and **destroy our stores.**) What **kind of a covering** may we expect these **night creatures** to wear?—(**Warm.**)
STAGE IV.—Characteristics and Uses.		
(1) Rats often **live in large colonies.**	Telling.	(1) *Mention* that rats have **become** so numerous in places as to be **a plague.**
(2) Rats have a large amount of **intelligence,** and are generally very **wary** of traps.	,,	(2) *Relate* any **short anecdote** *apropos* of the rat's intelligence or wariness. *Mention* how rats **find their way into ships.**
(3) The shyness of the rat is **a wise caution rather than timidity.**	,,	(3) *Offer in contrast* the **absolute timidity** of the **mouse.**
(4) Rats are useful as **natural scavengers** in sewers and drains.	,,	(4) *Commend* the creature's **admitted usefulness** in this important **sanitary matter.** *Show how* offal and all kinds of animal and vegetable waste **decay.** *Show how* **decaying matter** stinks and **pollutes the air.** ,, **polluted air** breeds **disease.** ,, **disease** becomes **epidemic in crowded towns.**
(5) In France rat skins are **tanned to make gloves.**	,,	(5) *Lead up* from previous step to a mention of **Parisian sewers,** and this **economical use** of skins of the myriads of rats found there.

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.

XIX.—SQUIRREL AND DORMOUSE

Objects.—Pictures of Squirrel and of Dormouse (or Living or Stuffed Specimens); Fur, Acorns, Beech-mast.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictures (or Specimens).		
(1) The squirrel and the dormouse are **two pretty creatures.**	Observation.	(1) *Compare* these two living pets, if possible, in preference to pictures, or even stuffed specimens.
(2) They are **alike** in having—	,,	(2) *Point to each* feature separately, as it is brought under observation.
(*a*) Warm **coats.**		(*a*) *Let* **fur** *be felt.* If no specimen animals are used, a bit of fur trimming will serve.
(*b*) Thick **tails.**		(*b*) *Contrast* the **tails.** That of squirrel, long, thick, and **bushy**; that of dormouse, shorter and **only thick at end.**
(*c*) Prominent **ears.**		(*c*) *Note* **tufted ears** of squirrel.
(*d*) Bright **eyes.**		(*d*) *Remark* on sharp, quick, **active appearance.**
(*e*) Long curved **claws.**		(*e*) *Let* **nature of claws** be thoroughly well *examined.* They are long, thin, sharp, and **much bent.**
(3) They are **unlike** in—	,,	(3) (*a*) *Call attention* to **thickness of fur** adding to apparent **bulk of body.**
(*a*) the **squirrel** being **larger than** the **dormouse,**		
(*b*) and having a **softer fur** and **bushier tail.**		(*b*) *Relate* the **size of the tail** to that of the body. The tail of **squirrel** appears **as large as its body,** that of the **dormouse much less** than its body.
(4) They are **gnawing animals.**	,,	(4) *Expose* the front **cutting teeth** (if possible); or show **contour of jaws** on the picture.
STAGE II.—Questioning on Foregoing Examination.		
(1) Both these creatures are provided with **warm coats,** as if they needed **extra protection** from cold **at some time.**	Questioning.	(1) Do the **coverings** of these creatures **seem more** or less **than usually thick?**—(More.) Will that lead us to think that they have some **need for warmth** or not?—(They have need.)
(2) They are both **bright, quick, and active-looking** creatures.	,,	(2) With bright eyes and sharp pointed ears, do **they look quick** and active, or dull and slow?—(Quick and active looking.)

SQUIRREL AND DORMOUSE—*Continued*

Objects.—Pictures of Squirrel and of Dormouse (or Living or Stuffed Specimens). Fur, Acorns, Beech-mast.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) The **claws** are long, thin, sharp, and much bent.	Questioning.	(3) The **cat catches prey** with her strong claws; but **what seems wanting** in the claws of these creatures for such hard work as holding struggling prey?—(**Strength.**) The **rabbit** has strong **claws for digging**; how are these **different?**—(**Finer and weaker.**) Besides **clutching** at food, and **digging** out burrows, what **other use** are claws put to—particularly sharp **curved ones?**—(**Climbing.**)
STAGE III.—Structure and Habits. (1) (*a*) The **squirrel** has **paws and claws** formed **for living in tree branches.**	Telling.	(1) (*a*) The squirrel **can spend** the whole of its **life in the tree-tops,** and needs to come **down to the ground but seldom.** **On the ground** the squirrel does **not** look near **so pretty** as on the branches, especially when **sitting up** on its large hind legs, with its tail or **brush curved overhead,** and using its **fore-paws like hands** to hold a nut or acorn. *Give* the **meaning of the name** squirrel as "tail shaded." Should the squirrel **jump** from a high branch to the ground, it spreads out its four **feet wide apart,** holds out its tail, and so **alights gently.**—(*Illustrate* by an open **umbrella.**)

Outline of a Dormouse.

Outline of a Squirrel.

(*b*) Its home is made in the trees because it is **able to find all the food and shelter it needs there.**	Questioning.	(*b*) *Gather from class* what is grown on trees (fruits and seeds) and particularly on large **forest trees (nuts, acorns, and beech-mast).** What kind of **teeth** has the squirrel for **getting at kernels** through hard shells?—(Gnawing teeth.) On **which branches** will these **nuts and seeds** be found, the large thick ones or the small and **weak branches**?—(Smaller branches.) *Infer* that its **body must be lightly built,** and that it can **skip from tree to tree.**
(*c*) As **no food** is to be found growing in the **winter** the squirrel **lays up a store** in some hiding-place each **autumn.**	,,	(*c*) *Question* on the **seasons,** and the falling of the leaves and seeds. *Infer* that **bare branches** would offer **no cover** or protection from observation, as well as **no food.**
(*d*) The **nests** (sometimes called "cages or drays") are two, **one for summer and one for winter;** they are made of hay, moss, and leaves.	Telling.	(*d*) *Picture* the **different aspect** of tree-tops in **winter and in summer.**
(i.) The **summer nest,** on some branch, well **hidden by foliage,** is where the **young are reared.**		(i.) *Infer* that **height** gives safety by **inaccessibility,** and **better cover** by thickness of foliage there.
(ii.) The **winter nest** is on a lower fork or hollow which is large and **well hidden** even when **no leaves remain** on the tree.		(ii.) *Infer* that **change of nests** for winter season **betokens a difference** in daily life at that period.
(*e*) The squirrel **sleeps** away the **winter,** curled **snugly** in its big bushy tail. Should some sunny day in winter **wake** it up, it makes a **meal** from its stored-up food, and goes to **sleep again.**	,,	(*e*) *Lead up* to this **marked change** in the creature's life—so busy and full of **activity in summer,** so quiet and **slumberous in winter,** when no food is found growing. *Compare* with **insect-eating creatures** which also **hibernate.** *Contrast* with **birds** that **migrate.**
(*f*) The **ears** are **tufted,** especially in winter, and **match its bushy tail.**	,,	(*f*) *Contrast* with large **ears of hares and rabbits,** which have **swift and crafty foes in dogs** and foxes. *Contrast* with thin **bare tails** of **rats and mice,** which **sleep in holes,** but **dare not cover** up their **ears.**

SQUIRREL AND DORMOUSE—*Continued*

Objects.—Pictures of Squirrel and of Dormouse (or Living or Stuffed Specimens); Fur, Acorns, Beech-mast.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		Infer the **security** of these winter nests hidden in the **deep hollow** of some great **tree-trunk.** *Liken* the large **bushy tail** to the **blankets** under which we **sleep in warmth.**
(2) (*a*) The **dormouse is like** the squirrel **in structure**, except that, (i.) it is **not so large**; (ii.) its **tail** is **not so** long and **bushy.**	Telling.	(2) (*a*) **Colour** and **shape** also **vary**, as *may be seen* from specimens or pictures.
(*b*) **In habit** the dormouse **differs** from the squirrel in—		(*b*) *Observe* that the **squirrel** always has the light appearance and **airiness of a bird.**
(i.) Making its home in **hedges and brushwood, not** in **high trees.**		(i.) The dormouse **has great activity** and is a **difficult** creature **to catch** as it **pops in and out** along the hedgerows.
(ii.) Its **summer nest**, for rearing its young, is only a few feet from ground; it is pretty, nearly round, woven of long grass, with the entrance neatly concealed. The **winter nest** is thicker, warmer, and provided with a store of nuts, haws, and grain.		(ii.) *Describe* nests. *Differentiate*—nests not so high up—food of smaller size (grain, &c.).
(iii.) Its habit of **sleeping all day** and going out **at dusk** in **search** of **food.**		(iii.) *Note* the syllable "dor" means **sleeping**: also that the **dormouse is nocturnal** (a night feeder), **as well as a hibernating** (winter sleeping) creature.

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.

XX.—THE MOLE

Objects.—A Dead Mole. Picture of Mole and Mole-hill.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Mole (dead Specimen or Wall Chart).		
(1) The mole is a little creature **like a mouse, with a long snout.**	Observation.	(1) *Examine* the **snout** well, and show how it thus **differs** from **mouse**, which has prominent **gnawing teeth.**
(2) It has very **short legs and tail**, and in general **shape** is like a **tip-cat**, the creature seeming to be **without any neck.**	,,	(2) *Discover* this **close, compact form** of the body. *Ask* where the **neck** is: *show* that the creature is **as thick and muscular there** as it is in the body.
(3) Its covering is a **dark coloured fur**; very **close, velvety, and upright**, and not lying in any direction, as hairs generally do.	,,	(3) *Let* **fur** *be felt and stroked. Have* all these **qualities** *brought to notice*, viz. that the **hairs** are short, close, upright, and velvety **to the touch.** If a specimen be available, the children may find that it has **an unpleasant smell.**
(4) **No ears**, and but very **small eyes** can be found.	,,	(4) *Let children search* for these features: tiny **eyes** may be **found hidden** in the fur.
(5) The **short, powerful legs** have strong paws armed with **stout claws**—	,,	(5) (*a*) *Feel* points of **claws**, and the bare, **wrinkled skin of the paws.**
(*a*) The **forearms** are set **outwards and backwards**, the **paws** being like little hands **covered with bare, wrinkled, hard skin.**		*Count* five curved **claws** on each paw—made **strong for digging purposes.**
(*b*) The **hind-legs** are **not** nearly **so powerful.**		*Liken* the fore-paws to a **digging instrument** which is a combined **spade and pick, all in one.**
		(*b*) *Contrast* **size and strength** of fore and hind **limbs.**

Outline of a Mole.

THE MOLE—*Continued*

Objects.—A Dead Mole. Picture of Mole and Mole-hill.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE II.—Questioning on Foregoing Examination.		
(1) The **body** of the mole is **formed for burrowing** tunnels through the earth.	Questioning.	(1) How do we make **instruments for boring holes**?—(With **sharp points.**) What may we think the mole does **with its strong and flexible** (bending) **snout**?—(**Digs.**)
(2) The **limbs and tail are short**, to suit a creature of **burrowing habits.**	,,	(2) What kind of limbs and tail **will** an animal **require** which is always **running through narrow tunnels**—large or small ones?—(**Small legs and tail.**)
(3) The **mole's skin** is **thick**, to keep out **damp** and chill, and its **close fur** is set **upright**, so that it never becomes ruffled or **disarranged in the narrow tunnels.** Its **colour** is **like** that of the **soil** itself.	,,	(3) If a creature **lives in the earth**, of what **colour** should his coat be?—(**Dark as the soil.**) How would the **soil affect long hair**?—(Get into it, and "dirty" it.) So what **kind is best**?—(**Short fur.**) If the creature has to **move both backward and forward** in narrow passages, **which way** may its **fur** be **without being "ruffled"**?—(Neither way—it is therefore set upright.) If a creature **lives in the cold earth**, what should its **fur** be?—(**Warm.**) And in **earth** that is **often damp**, what kind of **skin** is needed to **keep out the chill**?—(Thick skin.)
(4) It has **no outward ears**, and but **very small eyes**, to be troubled by the **loose soil.**	,,	(4) If the mole had large **open ears**, how would **loose soil** affect them?—(**Get into them.**) And if it had **large eyes**, what would the **soil** do then?—(Get into them and **make them sore.**)
(5) The mole digs forwards, and the hind limbs throw the dirt out behind it.	,,	(5) If the mole **digs forwards**, which **digging legs** will first attack the hard earth?—(**Fore.**) And when the **hind legs** come to the **loosened earth**, what will they do to it?—(**Throw it out behind.**)
STAGE III.—Structure and Habits.		
(1) The mole is a little creature **specially** made **for burrowing**—it has	Questioning and Telling.	(1) *By rapid questioning, gather up the points* made in the preceding stages.

(*a*) A **round body.** (*b*) **Pointed snout.** (*c*) **No** thin **neck,** but a head set on the **body** by thick, **strong muscles.** (*d*) **Short, strong limbs,** armed with **claws** for digging. (*e*) Its **skin** is **thick and stout,** covered with **velvety fur,** nearly black and set upright. (*f*) **Eyes small,** and sight feeble; **no outward ears,** but **inner ones** with **sharp powers of hearing.**		(*a*) *Liken* to a **gimlet** or other round boring tool. (*b*) *Liken* to point of gimlet or **point of pick.** (*c*) *Demonstrate* the **weakness** of any **boring tool with a thin neck** close to its working point. *Compare* **rooting** propensities of the **pig.** (*d*) *Show* the **uselessness of long limbs** for tunnelling purposes—**colliers work** kneeling or lying. (*e*) *Connect* these provisions with **requirements for them**—cold, **chilly earth** and dark, dirty, **confined tunnels.** (*f*) *Recall* necessity for small eyes; *infer* that **sight is of little use in darkness**; *tell* that **acute hearing compensates** (makes up for) poor sight. *Demonstrate* **conducting power of the earth** for conveying sound—thump the ground for a distant and blindfolded scholar with ear to the ground to count thumps.
(2) The mole is **seldom seen above ground,** because it is able to **find all its food underground.**	Reason.	(2) *Argue* from cause to effect here. *Let pupils try to enumerate* the articles of **food likely to be found** in the earth.—(Insects, larvæ, grubs, earthworms, snails, frogs, and sometimes dead birds.)
(3) The mole has a **strong sense of smell to guide it** towards its food.	Telling.	(3) *Offer* this sense as **another compensation** for its being **purblind.**
(4) It is a **voracious** (always hungry) creature, with **teeth** formed for **holding and tearing prey,** but not for chewing.	,,	(4) *Describe* the teeth as long, **jagged points**; and the mole itself as a **fierce little thing,** quite ready to **fight** any intruding mole, then **kill** and **devour** it.
STAGE IV.—Characteristics. (1) The mole **works at all seasons,** but seems **busiest** in **spring.**	Telling.	(1) *Ask* why it **tunnels,** what it **finds,** and what it **eats.** *Prove* that it must **destroy enormous quantities of larvæ** and perfect **insects.**
(2) It **prefers** fertile and **cultivated lands,** as wet and stony regions do not suit the **making** of its home or **mole-hill.**	,,	(2) *Display* picture of **mole-hill,** pointing out and very briefly explaining its various parts. (i.) A large, round, **central apartment,** the **roof** almost **level** with the **ground above.** (ii.) **Circular galleries,** one near **summit,** and other larger one at **bottom.**

THE MOLE—*continued*

Objects.—A Dead Mole. Picture of Mole and Mole-hill.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		(iii.) **Radiating trenches,** in a **maze,** for greater security by defying pursuit. The **central fortress,** which is often placed **under a tree-root** or high bank for security, can **only be approached** by a **round-about way,** and by knowing the right passages.
(3) Moles often **do mischief to lawns** and cultivated lands.	Telling.	(3) *Ask* who has seen the **loose earth,** called "**mole heaps,**" which is the **waste thrown up** by the little miner—heaps which so disfigure lawns.
(4) But they **do good** also by **letting in rain and air** to the **roots** of plants.	,,	(4) *Commend* the little "drain-maker" for being **really a farmer's friend** in this respect.

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.

XXI.—THE HEDGEHOG

Objects.—A Hedgehog (living or dead) and Wall Picture of same. Porcupine Quill. Specimens of Plaintain, and of destructive Beetles.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I. — Examination of a Specimen or Picture.		
(1) The hedgehog is a **curious little animal** with a **strange covering.**	Observation.	(1) *Ask,* **how different** to other creatures?—(Its **coat is of prickles** or quills.)
(2) Its **covering** is not fur, nor hair, but **prickly spines.**	,,	(2) *Differentiate* these **forms of covering.** *Feel* the **points** of the spines, and the **mobility** of them.

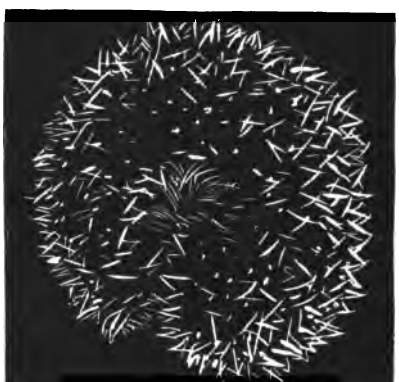
(3) The **spines** are of a **dirty white colour**, with a **bar of black** through the middle. **Under** the body is a covering of **yellowish hair.**	,,	(3) *Let it be noted* that the **length of the quills** (about 1 inch) makes the **animal appear large.** *Examine* the **hairy underparts.** *Show* **porcupine quill** for comparison and contrast.
(4) Its **body seems large** for its head and legs; **tail** is very **short.**	,,	(4) *Point out* these three features.
(5) It has a **snout,** like the pig and the mole, on a **small head,** with **small ears.**	,,	(5) *Compare* with snout of **mole,** and *be sure to name* the snout of **pig** for future reference.
(6) The **legs** are **short** and somewhat **feeble**: there are **five claws** on each foot.	,,	(6) *Have* toes *counted,* and **comparative weakness of legs** *noted.*
STAGE II.—Questioning on Foregoing Examination.		
(1) The hedgehog has a **covering** of prickly **spines or quills.**	Questioning.	(1) **How** are **animals** most **frequently covered?**—(Hair, fur.) But **how** is the **hedgehog covered?**—(Spines or prickles.) Are these **sharp** or blunt?—(Sharp.) Fixed by the **skin,** or allowed to **move freely** by it?—(Movable.)
(2) The spines are of a **colour not unlike the soil.**	,,	(2) If a hedgehog ran along the **side of a hedgerow** bank why would it be **difficult to see it?**—(Because of its dirty white and black colour.)
(3) There are **no spines** on the **underside.**	,,	(3) If a hedgehog had to be folded, or **rolled up,** which would **fit closely together,** the spiny back, or **hairy underparts?**—(Undersides.)
(4) The **legs and tail** are **short.**	,,	(4) And in **rolling** the creature **into a close round ball,** which could be more **readily tucked in, short limbs and tail,** or long ones?—(Short ones.)
(5) As the hedgehog **cannot run away** from its enemies, its **spines** are its **means of defence** against them.	,,	(5) Do the hedgehog's **legs** appear to be long and strong for speed, or **short and weak?**—(Short and weak.) If the creature **cannot run away** swiftly from a dog, fox, or other **enemy,** what does it possess in the shape of **weapons to defend itself** from attack?—**(Spines.)**
(6) The **snout and claws** seem to show that the hedgehog is **a digging animal.**	,,	(6) Why are the pig and the mole **furnished with snouts?**—(For **rooting** up food.) What **other features for rooting** and **digging** up things does the hedgehog possess?—**(Claws.)**

THE HEDGEHOG—*Continued*

Objects.—A Hedgehog (living or dead) and Wall Picture of same. Porcupine Quill. Specimens of Plaintain, and of destructive Beetles.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE III.—Structure and Habits. (1) The hedgehog gets its name because it has a **snout** and a thick **body like a pig**, and **lives in the hedges.**	Telling.	(1) *Give* (or *obtain*) the word "hog" as an alternative **name** for "pig. *Connect* its habit of **living in the hedges** with the first part of its name.
(2) The creature is **neither strong enough to fight,** nor **swift enough** to **escape its enemies,** and is therefore provided with a means of **defence** in its covering of **spines.**	,,	(2) *Review* these points again. *Mention* some flesh-eating **foes,** as fox and weasel.
(3) For **defence** the hedgehog **rolls itself into a ball,** carefully **tucking inside** its legs, its little tail, and its snout; **to move** this coat of **prickles** there is a broad band of **muscle stretched along the sides and round the body.**	,,	(3) *Teach* the **elasticity of muscles.** *Trace* the course of this muscle on picture or specimen. *Demonstrate* **invulnerability** when all **unprotected parts,** as head, tail, and limbs, are **tucked inside** this defensive armour. *State* that the **bravest dog** and the **slyest fox hesitate to attack** a hedgehog on the defensive—even as cavalry are puzzled, and find a formation of **fixed bayonets** difficult.

Outline of a Hedgehog (unrolled).



Outline of a Hedgehog (rolled up).

		Illustrate by a round **pincushion stuck full of pins**, but with all the points outwards.
(4) These **spines** are curved, and set in a **ball-and-socket joint**, so that when the animal contracts itself into a ball, all the **prickles stick right out.**	,,	(4) *Draw* the **curvature** on B.B.—it is **a sudden bend** near the **root.** *Illustrate* ball-and-socket joint by moving the arm from the **shoulder,** and *contrasting* with the hinge joint at the **elbow.**
(5) This **curvature,** together with the freedom of movement, does **not allow** the **spines** to be **driven into the creature's body,** if a weight should fall upon it.	,,	(5) *Admire* this wonderful form of **construction,** which enables the creature to level such **an array of straight spears** at its foes, yet presents **no straight points** at the inner ends where-with it could **transfix itself.** *Relate* that the hedgehog has been known to roll itself up and **purposely fall from a great height,** the elasticity of its coat-armour **preventing** the slightest **injury.**
(6) The sharp **snout** enables the hedgehog **to grub** and root up its food.	,,	(6) *Gather* that its **food** consists of what is **found in or on the ground**—grubs, and **especially beetles** (insects with **hard wing cases**).
(7) It is an **insect-eater,** with grinding **teeth** for **crushing purposes,** and with front teeth for **cutting and tearing** its prey to pieces.	,,	(7) *Tell* how the animals can **crunch beetles,** and even break through **snail-shells**: how it is known **sometimes** to get **a snake** or a chicken and **crunch** it up to the very **bones**: and although insectivorous it **usefully eats up the roots** of some **weeds** (as plaintain grass). *Infer* that by eating beetles and weeds it is a **friend to the farmer.**
(8) It lives in woods and **hedgerows, prowling about at night** in search of food.	,,	(8) *Say* that its **little black eyes** are suited to **night-hunting.**
(9) It makes a **nest** of leaves and moss in the **hollows of trees** or **holes of rocks** and **hedge-banks.**	,,	(9) *Inform* that in this home it **rears its young in the summer** when food is plentiful, and **sleeps with its mate through-out the winter,** but does **not** lay up a **hoard.**

Review by Recapitulatory Questioning to bring out Salient Points in each Stage.

XXII.—FROG AND TOAD

Objects.—A Frog ; a Toad ; Picture of Frog, Tadpoles, and Toad (to one scale). Frog Spawn, Toad Spawn, and Tadpoles in water, if procurable.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Frog.		
(1) A **frog** is a little creature which can live **on land or in water.**	Observation.	(1) *Pass round* a frog in a cage, or covered glass dish, with moist grass at the bottom. *Put* the frog into a pan of clear water to **see it swim.**
(2) The two **front legs** are **short,** the **hind ones long,** and much **stronger** in make.	,,	(2) *Notice* the **powerful** kick of the **hind legs in swimming.** *Put* frog on **floor** and stir it till it moves by a **jerky jump.**
(3) On the **fore legs** are **four toes** each, **like fingers** ; on the **hind legs** are **five toes, webbed** for swimming.	,,	(3) *Count* the toes—*note* the **thumbless hand** of fore limb, and the **great web feet** of hind limbs.
(4) The **skin** of the frog is **soft** and **slimy,** and **cold** to the touch.	,,	(4) *Select some children to touch* and become practically acquainted with these three qualities.
(5) The **eyes** are large and **prominent,** and the **mouth** is very **wide.**	,,	(5) *Try to open and display* the frog's mouth—feel the **sticky tongue,** and *note* the tiny **sharp teeth,** all in the **upper jaw,** and **set backwards.** Or *sketch* the mouth, tongue, and teeth *on B.B.*
(6) The frog **swallows its food whole,** and neither bites nor chews it.	,,	(6) *Try* to get frog to **eat a worm**—*note* how quaintly the **fore-paws** are used **to stuff** the mouth full, **like the fingers** of a greedy boy.
(7) [*Note.*—If this lesson be given in the spring of the year, some frog **spawn** and **tadpoles** may be procurable.]	,,	(7) *Pass round* some frog **spawn,** and *try to handle* the **slippery mass.** Or show **picture** of eggs and tadpoles in various **stages of development.**
(8) The **toad** is like the frog, but **larger, darker,** and **drier** in appearance.	,,	(8) *Pass round* the toad and *compare* with frog : it is (*a*) **larger** ; (*b*) **darker** and **drier,** with kind of **wart** on the skin ; (*c*) **hind foot not webbed so much.** *Put* toad *on floor* and stir it till it **crawls.**
STAGE II.—Questioning on Foregoing Examination.		
(1) The frog lives **a double life**—partly on land and partly in water.	Questioning.	(1) We can only live on land, and fishes only in water ; **why** should the frog be **called a double-lifed creature?**—(It can live on land or in water.)

(2) The frog has hind legs much larger than its fore legs, and it is **classed as a "leaper."**	,,	(2) If the frog's **hind legs** are so **much larger** than its fore legs, so that it **cannot walk evenly on all four,** like a horse or a dog, how may we expect it to **move along?**—(By **jerky jumps or leaps.**)
(3) The frog is a **powerful swimmer.**	,,	(3) What is the **use** of **web-feet?**—(For swimming.) If the frog has **web-feet on very long and strong legs,** what sort of a swimmer must he be?—(A **good swimmer.**)
(4) The frog has a **naked, soft, and porous skin, through which it breathes.**	,, Telling.	(4) **What three things** did you notice when you **touched the frog?**—(Soft, cold, and slimy.) *Tell* that the skin is **soft and naked** because the frog has **to breathe** through it; it is full of **tiny holes** and must be **kept moist.**
(5) It is a **cold-blooded** creature.	Questioning.	(5) When we **dive into water,** how does it **feel** to our **warm-blooded bodies?**—(Cold.) What **kind of blood** must frogs and fishes have **to be able to live in water?**—(Cold blood.)
(6) The **slime** on its body enables it to **move easily through water.**	,,	(6) **What** has the frog on its body to **enable it to slip** easily **through the water?**—(Slime.)
(7) The frog has **good eyesight** for **detecting** insects, and a **wide mouth to fling them down** as soon as they are caught.	,,	(7) If you wish **to catch quick-flying insects,** must your eyesight be poor or good?—(Good.) And if you wished **to throw them into a bag,** would you choose a wide-mouthed bag or a narrow-mouthed one?—(A wide-mouthed one.) **Now the frog catches and eats** insects, so why do you suppose **he has large staring eyes and a gaping mouth?**
(8) The **Toad** has a **puffed-out appearance,** has **not so moist** a skin, and does **not take to the water so much** as the frog.	,,	(8) What **differences** were noted between the **skin** of the Toad and that of the Frog?—(The toad had a drier and more puffy appearance.) Does the toad appear **to lead** more or **less of its life in the water?**—(Less.) How is that **also shown** by its **hind-feet?**—(They are **less webbed.**)
STAGE III.—Structure and Habits.		
(1) The frog is an **insect-eater,** but being **slow to chase,** is **quick** at **seeing,** and **rapid** in its **movements** for catching the prey.	Telling.	(1) *Let this proceed naturally and immediately* from last steps of previous stage.
(2) Its **tongue** is **flat,** like a **strap, fastened,** not at the back, but **at the front of the lower jaw.**	,,	(2) *Illustrate* by a **flail-like** strap, flung out at some mark, and jerked back again into the hand.

FROG AND TOAD—*Continued*

Objects.—A Frog; a Toad; Picture of Frog, Tadpoles, and Toad (to one scale). Frog Spawn, Toad Spawn, and Tadpoles in water, if procurable.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) The frog gets within **striking distance of prey**, such as flies, bees, or ants; and **then flips out** its flail-like tongue at the insect, **like a flash.**	Telling.	(3) *Imitate* this **stealthy approach**, and **rapid execution.**
(4) The **tongue** being **sticky**, the **prey adheres** to it, and is **instantly flung down** the **throat.**	Telling and Questioning.	(4) *Repeat questions* on the **wide gaping mouth** of the frog. *Compare* with mouths of swallows and other insect-eating **birds with gaping bills.**
(5) The frog **sleeps through the winter**, when no insects are to be found; in March the frogs **wake up**, and **begin to lay their eggs.**	Telling.	(5) *Impart* this information *briefly.* Add that frogs **sleep in holes** or at the bottom of ponds, nourishing themselves on their own bodies, and managing to **breathe slightly**, but enough to maintain life. *Compare* with **other hibernating animals**, as hedgehog and snake.
STAGE IV.—Development of Frogs.		
(1) Frog's **eggs** are **black**, about size of pin's heads, and **coated in jelly**; found on the surface of ponds in spring time. **Frog's spawn** is in **masses**: the **toad** arranges its eggs in a **double string.**	Telling.	(1) *Connect* this with immediately preceding step. *Outline the subjects* of this stage very *briefly.* *State* that the **parent takes no care** of the eggs after laying them.
(2) The **slippery coat** of jelly **protects the eggs** from being devoured, and from crushing each other, till they get **hatched by warmth of the air.**	,,	(2) *Enumerate* **enemies** which **devour eggs**—fishes and water-insects. *Mention* that **ducks** are able to **eat frog's eggs**, though with **difficulty**, the slippery mass almost eluding their **spoon-like bills**—such is the protection of the jelly coating. *Note* that the eggs **need no light** to hatch them, but **warmth**, as eggs generally do.
(3) The **eggs get bigger** by sucking up the water, then **rise to the surface**, and in about **ten days hatch** into tiny **tadpoles.**	,,	(3) *Explain* **tadpole** to mean "tailed poll" or "all head and tail."

(4) They **begin life** as fishes, breathing **with gills**—little pink tufts.	Reason.	(4) *Simply argue* that they **must breathe in the water,** and therefore differently to land animals—*mention* **gills,** but *defer explanation* of them to a future lesson (on Fish).
(5) **Tail** gradually **disappears; legs grow out,** hind pair first; **gills change to lungs,** like those of a **true land animal.**	Telling.	(5) *Trace* the **outward developments** *rapidly* by pointing them out on the wall picture: the **internal changes** *may only be mentioned. Show* that full-grown **frog** is quite **tail-less,** while the **tadpole** depended on **tail** for its **swimming power.**
(6) In **breathing** the frog has **no ribs to expand** when the air goes in. The **air is simply swallowed,** and **additional air** is taken **through the moist skin.**	,,	(6) *Let scholar* place hands on chest and *feel* **expansion** at each **inspiration.**
(7) The frog **grows very fast,** not only **drinking water** with its mouth, but **absorbing** it **through** the **sponge-like skin.**	,,	(7) *Argue* that frogs **always require moisture**—they live near **ponds and pools.** In about a **year** the frog is **full-grown.**
(8) The frog **casts its skin,** rolls it up into a ball, and **swallows it.**	,,	(8) *Compare* the **casting of the coat** with that of **other creatures,** as snakes. *A humorous description* of Froggy stuffing his old coat down his throat, like a great pill, may *bring the lesson to a bright termination.*

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.

Outline of a Frog.

Outline of a Toad.

XXIII.—EARTHWORM

Objects.—Earthworms (sufficient to give one to each child, if possible ; and a large one on a shallow glass dish for use of teacher) ; a piece of stiff earth with some worms in their burrows.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of an Earthworm.		
(1) A worm is a **long, round, soft body, pointed** at each end : it is **red and slimy.**	Observation.	(1) *Guide* the children's *observations to note* these six points.
(2) The body is **made up** of a number **of rings.**	,,	(2) *Draw attention* to the rings, and let children **try to count** them. *Note* that **front rings** are much **larger and fuller** than hind ones.
(3) One end **forms** the **head,** and the other the **tail.**	,,	(3) *Direct children* to **gently stir** the worm with their pencils to see if it will **lift up** one end.
(4) On the **underside** of the body are some **hairs or little bristles.**	,,	(4) *Direct children* to draw the **underside of the worm** across the back of their hands to *feel* something rough on that side—particularly if worm be **drawn backwards.**
(5) The earthworm **has feeling.**	,,	(5) *Direct* children to allow the worm to **be quiet,** and then to touch it again and **see if it moves.**
(6) **Its earth-burrows** are well-made tunnels.	,,	(6) *Point out* the **perfect roundness** of some of the **empty worm-burrows.** Show that they **do not collapse** or fall in when the worm leaves them.
STAGE II.—Questioning on Foregoing Examination.		
(1) The earthworm is a **creeping thing,** and so its body is **round, soft, and long** ; it is **pointed** at the end for **boring in the earth.**	Questioning.	(1) Do men **move more freely** or less freely when in **hard, stiff armour?**—(Less freely.) If the worm has to **move without the aid of limbs,** such as legs or wings, would it be better for **its body** to be stiff or to be **soft and easily bent?**—(Soft for bending.) If it has to **twine and curve** will it be **easier for a long** or a short **body** to do so?—(A long body.) If it has also to bore into the

earth, what is the **best shape for a boring tool?—(Round and pointed.)** *Illustrate* by a gimlet.

(2) The worm is made up of **rings** (or segments) **tapering at each end**; but it is **difficult to see** which is the **head** and which the **tail.**

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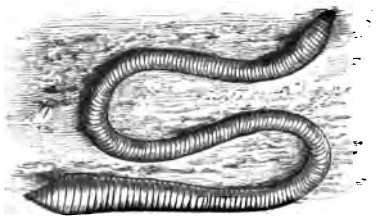
(2) **How** is the **body** of a worm **formed?**—(It is **ring-formed.**) Do these **rings** seem quite stiff or rigid, or do they appear **elastic and freely jointed** one to the other?—(Freely jointed.) What **limb** can be found?—**(None whatever.)** What can you **find** in the shape of eyes or **mouth** to mark which end is the head?—**(Nothing with the naked eye.)** But what did you notice when you **stirred** the worm with your pencil?—**(It raised one end.)**

A Worm's Bristles or Hooks.

Telling.

Tell that this end was the **head,** and that a **magnifying-glass** would **show a mouth** of two **soft lips**; the round opening of which is **hidden** by the **overlapping of first segments.**



Outline of an Earthworm.

(3) Although the worm has **no limbs,** the underside **has hairs** or little bristles **sticking out,** by which it can **hold firmly.**

Questioning.

(3) What did the **roughness** on the underside of the worm **feel like?**—(Hairs or bristles.) If any one were trying to **pull or push you over,** would you keep your **feet** close together or stride them out?—(Stride wide.) **What** do you think **aids the worm** to hold or **steady itself?**—(These **hairs sticking out.**)

(4) The worm has nerves, and **can feel.**

,,

(4) **If** the worm **moved as soon as you touched it,** what does that **prove** about the worm?—**(It can feel.)**

(5) Its runs or **earth-burrows** are **lined** and **held together by a slime** which comes out of the creature's body.

,,

(5) **What** did you **feel** which seemed **to cover the body** of the worm? (Slime—something **sticky.**) **This sticky slime comes out of the worm's body,** and if it **plasters** the loose **crumbling earth** with it **while boring** its tunnels through, **what** will this **slimy cement do to the inside** of the tunnel?—(Cement it together.)

EARTHWORM—*Continued*

Objects.—Earthworms (sufficient to give one to each child, if possible ; and a large one on a shallow glass dish for use of teacher) ; a piece of stiff earth with some worms in their burrows.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE III.—Structure and Habits.		
(1) The earthworm is **made up of rings** which **can move** in almost **any direction.**	Telling.	(1) *Teach* that it has **stretching muscles.** *Remind* of a **wriggling worm** turning in all directions. *Mention* that a full-grown worm has as many as 150 rings.
(2) On many of these rings are **four pairs of minute bristles,** pointing **backwards,** and which can be **extended at will.**	,,	(2) *Reason* out the backward direction as offering **no resistance to progression.**
(3) These bristles **enable** the worm **to hitch itself along** when its elastic muscular body is **stretching and contracting.**	,,	(3) *Describe* this method of **locomotion—thinning and thickening the body in turn,** drawing the tail after the head. *Note* that worms **seldom leave their holes entirely,** generally holding fast by the tail, and withdrawing when danger threatens.
(4) The **taper head,** and the **pouring of slime over the body,** assist the **boring operations.**	,,	(4) *Illustrate* by the oiling of a gimlet.
(5) The **swelling of the body enlarges the tunnel.**	,,	(5) *Refer* again to this thinning or **stretching** of the fore part, **followed by the thickening** and contracting as the body draws forward.
(6) Worms are **red blooded,** and **breathe all over their bodies.**	,,	(6) *Remind* that they **need air,** like other living creatures.
(7) Worms **swallow earth** to get out of it the decaying **vegetable matter** which **forms their food.**	,,	(7) *State* that the **earth is full of such matter,** as dead and decaying leaves, and that the worm **finds these portions** of the soil **nutritive.**
(8) The worm has **neither tongue nor teeth** ; but its **stomach** uses the **digestible portions** swallowed, and **casts out** the indigestible **earth.**	Memory.	(8) *Remind* children of the "**worm casts**"—little heaps of twisted soil curled round and round, which may often be seen on lawns and garden paths. A worm cast may be carefully gathered on to a piece of glass or platter for exhibition to class.

STAGE IV. — Usefulness of Earth-worms.		
(1) Worms are **great fertilisers,** as they bring **fresh** and good **soil** to the **impoverished surface**; they **loosen** the **soil,** and so **let in air and rain.**	Telling.	(1) *Set forth* the great **usefulness** to man of the **despised worm**— (*a*) It brings **fresh soil from a depth** to put it on the surface **where it is required.** (*b*) It really **converts soil** into a rich **manure.** (*c*) It **nourishes the crops** by letting in **air to the roots.** (*d*) It **helps the drainage** of the land by making its **little tunnels**; and at the same time **allows the rain to reach the roots** of plants more readily.
(2) Worms are used as **bait** by fishermen, and they provide **food for birds** and other animals.	,,	(2) *Gather* these **minor uses** *from the children's own knowledge* and the matter of preceding lessons.

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.

XXIV.—THE WHALE

Objects.—Picture of Whales (Greenland and Sperm); Whalebone; some Train-oil and Sperm-oil.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture and Object.		
(1) The whale is a **large animal** in the **shape of a fish.**	Observation.	(1) *Avoid designating* the whale "a fish."
(2) It is about the **length** of the school-room (say seventy feet).	,,	(2) *Give a concrete idea* of this length by *comparison* with present surroundings—"seventy feet" conveys no definite idea to a child.
(3) Its **head is very large,** even compared with rest of its great body.	,,	(3) In the **sperm whale,** the head is about **one-third of the vast bulk.**
(4) Its **nostrils** (or nose-holes) open on the **top of its head.**	,,	(4) This may possibly be *shown on picture* by the **"blowing."** *Contrast* these upward nostrils with our downward nostrils.
(5) The **mouth** is so large that two men could stand in it.	,,	(5) If the *picture displays* the **plates of baleen** (whalebone) in the upper jaw, *pass round* specimen for examination.

THE WHALE—*Continued*

Objects.—Picture of Whales (Greenland and Sperm); Whalebone; some Train-oil and Sperm-oil.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(6) The **eyes** are set near the junctions of the two lips.	Observation.	(6) *Comment* on **smallness of eye** for so large a creature.
(7) Instead of legs it has **flippers for swimming.**	,,	(7) *Compare and contrast* with our **arms**, or the **wings** of a bird, or the **rayed fins** of a real fish.
(8) The **tail** is **wide across** (over eighteen feet), and **set horizontally.**	,,	(8) *Draw attention* to **setting of tail** "across," and not "up and down," as fishes generally have their tails. *Give concrete idea* of its width by measuring about six paces on the floor.
(9) The covering of the whale is a **hairless, glossy skin** of **black**, except on the underparts, which are grey.	,,	(9) *Note* velvety appearance of skin.
STAGE II.—Questioning on Foregoing Examination.		
(1) The whale **lives in the sea.**	Questioning.	(1) **Where** do **fishes live?**—(In water.) **Where** does the **whale live?**—(In water—in the sea.)
(2) **Swimming** by the aid of **flippers and tail.**	,,	(2) **How** does it **move through the water?**—(It swims with its flippers and tail.) What has it at the **end of its body**, and by which it **mainly moves?**—(**Big tail.**)
(3) The **tail** is very **large and powerful**, and is **set crosswise.**	,,	(3) **How is** the tail **set** on the body?—(**Crosswise.**) **How** will such a **tail strike the water most forcibly**, up-and-down or side-ways?—(**Upwards and downwards.**)
(4) The **nostrils** of the whale **open upwards** for convenience of breathing.	,,	(4) What do we call **going down** in the water?—(**Diving.**) When **a boy** dives, why does he have to come **to the surface again so soon?**—(**To breathe.**) **What part** must he get **above the water** to do so?—(**His nostrils.**) Suppose the **whale wants** to come up **to breathe**, which will be **most convenient**—for its **nostrils** to open above, or underneath?—(**To open upwards.**)

(5) The whale is the **largest animal in the world,** and is covered with a **naked skin.**	,,	(5) *Name* some large land animals.—(Horse, elephant.) How are such **animals generally covered?**—(With a thick and hairy skin.)
	Contrast.	*Tell* that the whale is much **larger** than **any land animal** (*compare* with the elephant), and its **skin is strong but hairless.** *Call it* the **"giant of the deep,"** a nickname which will *remain and impress.* (This Lesson deals almost exclusively with the **Greenland whale,** the largest of all.)
STAGE III.—Structure and Habits. (1) The whale is **not a fish,** because— (*a*) It **suckles its young.**	Telling.	(1) *Differentiate briefly* for junior classes. (*a*) *Say* that the members of a whale **family** are known as **cow, calf, and bull.** *Note* that **fishes lay eggs.**
(*b*) **Breathes by lungs** and not by gills.		(*b*) *Refer* to **gills** of a herring, or other table fish; or, better, *to memory* of the **manner of breathing** by living fish, as seen in a globe of water. *State shortly* that **water-breathers** require gills, and not lungs. **How** does a **boy breathe?**—(By **lungs.**) Therefore, when a boy dives in water, why is he **forced to come to the surface** again very soon?—(To breathe.) If you are told that for the **same reason the whale comes to the surface regularly** to breathe (every forty minutes or so), **will you infer** that he has gills like a fish that remains constantly under water, or **lungs like a land animal?**—(Lungs.)
 Outline of a Whale.		
(*c*) And has **warm blood;** its heart is similar to that of **a land animal.**		(*c*) *Comment* on the **coldness of a fish to our touch**—*infer* that we, and all **land animals,** are **much warmer**—that we have warm blood, while they have cold blood.
(2) Although the **whale is organised** (built, or constructed) **to live in water,** it **has to breathe above the surface:**	,,	(2) *Remark* on **outward shape** being like that of a fish, and **inward organs** like those of a land animal—yet **all adapted to its mode of life.**
(*a*) The **head is raised just above the water.**		(*a*) *Note* how **exhausting** it is to a boy or a land animal **to lift the head for breathing** when swimming, whereas the **nostrils of the whale readily reach the outer air.**

THE WHALE—*Continued*

Objects.—Picture of Whales (Greenland and Sperm); Whalebone; some Train-oil and Sperm-oil.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*b*) It **breathes, or "blows,"** or "spouts" for eight or ten minutes, **forcing a column of water** high into the air.		(*b*) *Call* the nostrils **"blow-holes"** (spiracles), and designate this action **"blowing"** or "spouting." *Say* that **whale fishers discover the presence** of the whale by the columns or fountains forced up by its breath.
(*c*) It sends up **seven or eight jets,** and at the **last blowing** the whale rises **high out of the water,** leaving only its tail underneath, **balancing** many times backwards and forwards.		(*c*) *Say* that the **jet** is the **hot breath** (with watery vapour and greasy particles) **forcing up** a column of **sea-water.** *Show* how the horizontal set of the **tail-fin** enables it to act as a kind of **a flat rest** or foot.
(*d*) The whale then **dives again, and remains below** at its **"soundings"** for about **forty minutes.**		(*d*) *Compare and contrast* with a **boy diver,** who can remain below **only a minute or two.**
(3) The whale **moves easily through the water,** owing to—	Telling.	(3) *State* that the whale can **travel a mile in three minutes.**
(*a*) The **amount of air** contained in the chest.		(*a*) *Note* how **swimmers fill their lungs** with air; and then the vast capacity of whale's lungs.
(*b*) The great **quantity of oil** contained in the tissues.		(*b*) *Promise to speak* presently of the large **amount of fat** found on a whale.
(*c*) The **vigour of its tail-fin.**		(*c*) *Refer* to the **expanse of the tail**: *relate* its **devastation** in tossing whole boats and their crews into the air.
(4) Underneath its thick skin is a **thick layer of fat, called blubber.**	,,	(4) *Infer* that this coat of **fat is needed to keep up the temperature** of a warm-blooded animal living in water.
(5) The whale **feeds on sea-animals** (shrimps, jelly-fish, sea-snails, &c.), **browsing** on these as it advances through the water.	,,	(5) *State* that the **Greenland whale has no teeth,** and therefore its **food cannot be chewed.** It has a **large tongue.**

(6) The **mouth is enormous**, yet the **throat is small** enough to be choked by a potato. So it is **provided with strainers** of narrow blades of baleen (or black, flaky whalebone) in the upper jaw, **to sieve each mouthful.**	,,	(6) *Explain* the process of screening, or riddling—*show* the **necessity** of this process in **selecting food** to suit the whale. *Exhibit* **whalebone** again. *Illustrate* **its arrangement** in the jaw by the laminæ of a feather.
STAGE IV.—Uses. (1) The whale is **hunted for two products—** (*a*) Whale-oil. (*b*) Whalebone.	Telling.	(1) *Relate briefly* **the hunting, harpooning, and cutting-up** of a whale. *Value* the yield of bone and oil at £500. (*a*) **Train-oil**, from boiled blubber, is a good **lubricant** for machinery. (*b*) **Whalebone** is used for **stiffening** corsets and whip-stocks. [No baleen is produced by the sperm whale of the Eastern Archipelago: it yields spermaceti, used for candle-making.]

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.

XXV.—A FISH

Objects.—A freshly caught Fish; Living Fishes in a Glass Globe of Water; the Backbone of a Fish; the Gills of a large Fish; the Roe of a Fish.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of a Fish. (1) A fish is generally of a **tip-cat shape**, thicker in the middle, and **tapering at each end.**	Observation.	(1) *Draw* a rough outline of the "fish shape."
(2) It is **covered with scales**, which are **flat and horny, fastened** to the skin **by their foreparts**, and **overlapping** by their hindparts.	,,	(2) *Take* the dead fish and **scrape** from head to tail, showing how few scales are fetched off: then **scrape backwards** to fetch them off more readily. *Let children examine* the scales.

A FISH—*continued*

Objects.—A freshly caught Fish; Living Fishes in a Glass Globe of Water; the Backbone of a Fish; the Gills of a large Fish; the Roe of a Fish.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) A fish **feels slimy and slippery** to the hands.	Observation.	(3) Have the slime **felt and smelt,** and then wiped from the hands. [warm hands.
(4) A fish **feels cold** to our touch.	,,	(4) *Direct scholars to feel* the fish, and then to feel their neighbour's
(5) (*a*) Fishes **move easily through the water,** using their **tail and fins.** [**side down.**	,,	(5) (*a*) *Watch* the fishes swimming in the globe; *note* the **use** of the powerful **tail in all movements.** *Display* a **fin** with its **rayed spines** arranged like a fan.
(*b*) A **dead fish floats** on the water **up-**		(*b*) Throw a dead fish in the water to *observe this.*
(*c*) The **bones** of a fish are **very light,** and the **backbone bends** very easily. [**teeth.**		(*c*) *Examine* the **backbone** of a fish *to discover* its **lightness and flexibility.** [pointed teeth.
(6) (*a*) A fish has **a number** of sharp **little**	,,	(6) (*a*) *Open the mouth* of the dead fish *to discover* its numerous and finely
(*b*) Fishes will **eat almost anything,** and **swallow their food whole.**		(*b*) *Throw into globe* bits of worms, fish, and insects *to see them devoured* by the living fishes.
(7) (*a*) Fishes **seem** to be **constantly drinking** water;	,,	(7) (*a*) *Then watch* the **mouth and gills** constantly at work.
(*b*) but the **water passes out again** at the side of the head;		(*b*) *Give the name* **gills,** if unknown to the children.
(*c*) where may be seen some red **fringe-like** things called **gills.**		(*c*) *Exhibit* the **gills** of a large fish—look dry and shrivelled, but **in living fish are red** and full.
(8) The **eyes** of a fish are **large** and always **wide open.**	,,	(8) *Note* the wide **staring eyes** of the living fishes.
(9) The **roe** of a fish **are its eggs.**	,,	(9) *Open a dead fish to exhibit* the roe—*discover* that it consists of tiny eggs.
STAGE II.—Questioning on Foregoing Examination.		
(1) A fish is **wedge-shaped** in order that it may **pass** the more **readily through the water.**	Questioning.	(1) When we want nails, pegs, pins, or **any kind of wedge** to pass readily through anything, **what kind of ends** must they have?—(**Pointed.**) **Why is a fish pointed** towards the nose?—(To pass more readily through the water.)

(2) **Scales offer the least possible resistance** to quick movement through the water.

(3) A **slimy skin** makes it **easier still** for the fish to go through the water.

(4) A fish has **cold blood**, and is **suited to live in water.**

(5) A fish is **formed for free and rapid movement** through the water; it sends itself along by its **fins**, of which the chief and **most powerful is the tail.**

Outline of a Fish.

,,

,,

,,

Questioning.

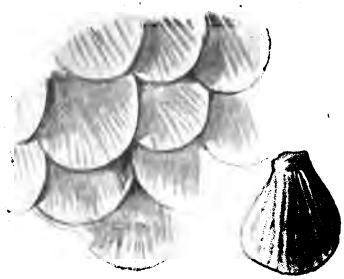
Telling.

Questioning.

(2) Name some different **kinds** of animal coverings.—(**Hair, wool, feathers.**) What covering have fishes?—(**Scales.**) Of all coverings, which will **keep closer to the body?**—(Scales.) Which will **not hold water** in at all, as wool might do?—(Scales.) So what kind of covering is **best suited to fishes,** closest to the body, holding no water, and **allowing free movement**?—(Scales.) *Illustrate* by **chain armour.**

(3) When we wish a **gimlet** to pass **more easily** into wood, what do we put on it?—(**Oil.**) What do you find all over the fish's body?—(**Oily slime.**)

(4) Which felt the **colder**, the **fish or your neighbour's hand?**—(The fish.) Why would you not like to be **kept long in a pool of water?**—(It is **too cold.**) Whose body **seems to be equally cold** and suited to life in **water,** yours or that of the fish?—(Fish's body.)



Fish Scales.

(5) What have fishes in the shape of **limbs** to send themselves along?—(**Fins.**) Which seems the **chief fin,** and the one which is **broad and upright and most powerful** for striking the water?—(Tail.) Alternative name, "**caudal fin**" may be *given at discretion*. *Then ask* how does a **dead fish** float?—(**Upside down.**)

Teach that the **other fins are really balancers,** and that if a live fish had its fins cut off it would roll over in the water.

Is the **backbone** of a fish in **one solid piece,** or in **small parts jointed** together?—(Sections.)

How does **this formation aid** the movements of the fish?—(Bends easily **for turning and twisting.**)

A FISH—*Continued*

Objects.—A Freshly caught Fish ; Living Fishes in a Glass Globe of Water ; the Backbone of a Fish ; the Gills of a large Fish ; the Roe of a Fish.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(6) The teeth of a fish are numerous, but are merely small sharp points, set backwards, for holding slippery struggling prey, and not for biting and chewing the food.	Questioning.	(6) If you feel **inside a fish's mouth,** what do you notice about the size, shape, and number of its **teeth**?—(**Many** of them ; mere sharp **spikes** ; and all set **backwards**.) Are such teeth **really useful** for cutting, for chewing, or for **holding slippery struggling prey**?—(Only for holding.) **How therefore must** a fish **swallow** its food?—(**Whole.**)
(7) A fish breathes by gills.	,,	(7) **What are fishes doing** when constantly **opening and shutting their mouths**?—(Breathing.) **Where does the water go** which is taken in to the mouth?—(**Passes out again** through the gills or **slits behind the head.**) **Why is it necessary** for the water to be constantly **passing over the red fringe-like gills**?—(To breathe, or take the air out of the water.)
	Telling.	*Tell this: and add* that **fishes** living in **strong streams** always keep their heads **upstream,** or the **current** would force its way into their gills and **choke them.**
(8) A fish has **good eyesight** for seeing in water. Its senses of **smell and touch** are also very good for **discovering hidden food.**	Questioning.	(8) On what do **most fishes** feed, **animal** or vegetable **food**?—(Animal. Carp are rather exceptional in this respect.) If a **fish has to hunt** other fishes for its prey, what kind of **eyesight** does it need?—(**Keen.**) And if it is **in turn hunted** by other fishes what kind of **eyesight** will be useful **for escaping**?—(Keen.)
	Telling.	*Add* that the sense of **smell** and the sense of **touch** are needed to discover **hidden food,** especially on the **bottom mud.**
(9) A fish lays a **multitude of eggs.**	Questioning.	(9) Were there **many** or few **eggs** in the fish?—(Many.) As fishes **devour each other,** should **many** or few be **hatched**?—(Many.)
STAGE III.—Structure and Habits. (1) A fish would **die out of the water,** as we should in it, **of suffocation.**	Telling.	(1) *Impress* this **great point of difference**—the breathing by gills instead of lungs.

(2) **Water contains air** which is taken out and breathed in by gills.	,,	(2) *Teach* that a **fish** put into **water without air** (distilled water) **would die.**
(3) A fish feels **cold and clammy** because it has **no more heat** than the **water.**	,,	(3) *Teach* that a **fish takes in so little air** when breathing—the faster we breathe the warmer we get (which *prove by experiment*).
(4) It needs **no warm covering,** because it has **no heat to keep in.**	,,	(4) *Make* this self-evident, from a knowledge of the **use of clothes.**
(5) Its **shape** as well as its **covering** aid it in **pushing through the water.**	,,	(5) *Demonstrate* the fish-shape to be a **pair of wedges,** joined at their bases, with **all sharp corners nicely rounded off,** for cleaving the water. *Prove* all **boats and ships** to be mere imitations of the **fish-shape.**
(6) **Fins vary,** but generally there are—(*a*) a pair of **breast fins** behind the gills; (*b*) a pair of **belly fins** under the middle of the stomach; (*c*) an **unpaired fin** on **back,** and one **under body** near the tail.	,,	(6) *Point out as named.* *Compare* the two breast-fins to **arms,** and the two belly-fins to **legs, corresponding** to four limbs on a man.

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.

XXVI.—A BIRD

Objects.—Stuffed Birds and Pictures of Birds; a Live Specimen in a Cage; Birds' Eggs (assorted and labelled), and a Nest of Eggs; prepared Fowl Bones.

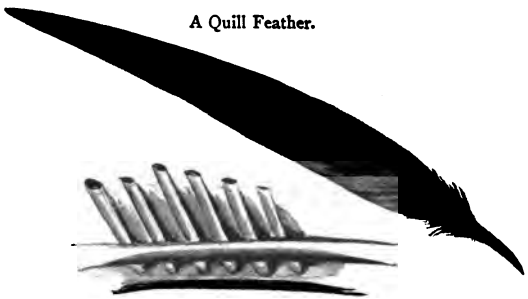
MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of a Bird.		
(1) A bird is a **two-legged** creature, **covered with feathers.**	Observation.	(1) The term "biped" may be *withheld from young scholars. Let* feathers be *stroked* and thoroughly *examined* as to texture and sizes.
(2) Its mouth is a **hard beak.**	,,	(2) } Prepared beaks and claws are most useful *for passing round the*
(3) Its feet are **claws.**	,,	(3) } *class*—those of ducks and fowls are easily procured.
(4) It has **wings.**	,,	(4) If teacher *flaps his arms* in imitation of a bird's wings, the **correspondence of the limbs** may be noticed.
(5) Birds **lay eggs.**	,,	(5) *Pass round* some **birds' eggs**—all carefully *labelled for identification.*

A BIRD—*Continued*

Objects.—Stuffed Birds and Pictures of Birds; a Live Specimen in a Cage; Birds' Eggs (assorted and labelled), and a Nest of Eggs; prepared Fowl Bones.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE II.—Questioning on Foregoing.		
(1) A bird is a two-legged creature, with **a covering of soft, warm, light feathers.**	Questioning.	(1) **How many legs** have dogs, horses, and many other **animals?**—(Four.) With what are **many animals covered?**—(Hair.) How do **birds differ** in these two respects?—(They have two legs, and they have a covering of feathers.) Who have **two legs** besides birds?—(**Men.**) When you **felt the feathers,** what did you **notice** about them?—(Feathers are soft, warm, and light.)
(2) The **feathers** on a bird's body are **not all alike**; the largest (**quill feathers**) are on the tail and wings; the **clothing feathers** cover the whole of the body; and beneath these are very **small,** soft, **fluffy feathers,** called down.	,,	(2) **Where** did we find the **largest and strongest feathers?**—(Tail and wings.) **Why** are these **wanted** so large and **strong?**—(To **fly with.**) What was the **use of the smaller feathers?**—(Clothing.) And of **the down** beneath them?—(To make a **thick, close** covering.) Would you call feathers a **light** or a heavy **covering?**—(Light.) Why do birds **need a light covering?**—(To rise in the air easily.) And a **warm covering?**—(It is cold high in the air.)
(3) A bird has **wings** instead of fore-legs.	,,	(3) **How many limbs** or legs has a **dog?**—(Four.) If a dog **sits up** on its hind-legs, what part of our body are its two **fore-legs** then like?—(Arms.) If we suppose a bird's two legs are like those hind-legs, **what has the bird like our arms,** or a dog's fore-legs?—(Wings.)
(4) While animals generally move about on or under the earth, many **birds fly in the air.**	,,	(4) What is the **use of wings?**—(To fly in the air.) Are birds heavy or **light creatures?**—(Light.) What then must be **more powerful the larger the bird** is?—(Its wings.) And the **more** a bird **uses its wings,** what will happen to them?—(**Become stronger.**)
(5) Instead of soft lips with teeth inside them, the mouth of a bird is a **hard, horny beak** or bill.	,,	(5) What do you know about the teeth of birds?—(**Birds have no teeth.**) What have they **instead** of **soft lips?**—(Hard, horny beaks or bills.)

(6) The feet of birds are **hard and horny claws,** with strong **nails,** more or less **hooked.**	,,	(6) What **kind of feet** have birds?—(Claws.) Is their **nature hard** or soft?—(Hard.) **How** are the **nails** of many of them **shaped?**—(Hooked.)
(7) Young birds are **hatched from eggs,** which the mother-bird lays, and **from the first** the parent birds feed them with **solid food.**	,,	(7) **Why** do birds **build nests?**—(To lay their eggs in.) When the eggs have been **sat on** and **kept warm** for a number of days, **what are hatched** out of them?—(Young ones.) You may have seen a **cat suckle her kittens** with milk from her own body; but **how does a mother-bird feed** her young ones?—(She carries food to them in her beak.)



A Quill Feather.

Quills fastened to the Bone.

A Shape Feather.

STAGE III.—Structure and Habits. (1) Birds have thin, **hollow bones** for greater **lightness.**	Telling.	(1) *Teach* that **weight and bulk** are **not** always **necessary** to give strength; as in a **bicycle.** *Illustrate* by strength of a **bamboo,** and *show* some hollow fowl bones.
(2) When we breathe the air is taken into our lungs; but **birds** breathe not only through their lungs, but **the air penetrates to every part of the interior** of their bodies, even into the cavities of the bones.	,,	(2) *Illustrate* by the inflation and rising of a **balloon.** *Add* that this **air is warm**—that the plumage is adapted to **keeping in the heat.**

A BIRD—*Continued*

Objects.—Stuffed Birds and Pictures of Birds ; a Live Specimen in a Cage ; Birds' Eggs (assorted and labelled), and a Nest of Eggs ; prepared Fowl Bones.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) Just as the teeth of animals **agree with their habits,** so do **the beaks of birds.** Outline of a Bird.	Telling.	(3) *Enumerate* (*pointing to illustrations at same time*)— (*a*) The beaks of birds of **prey** (eagle, hawk, owl) are **strong, hooked,** and **pointed.** (*b*) The beaks of **fishing** birds (heron, stork, crane) are **long, slender,** and **pointed.** (*c*) The beaks of **boring** birds (woodpecker) are **straight, strong,** and **pointed.** (*d*) The beaks of **water-fowl** (duck, swan) are **broad, flat,** and **spoon-shaped.** (*e*) The beaks of **seed-cracking** birds (crow, sparrow) are **short, hard, strong,** and **cone-shaped.** A Down Feather. (*f*) The beaks of **nut**-cracking birds (parrots) are **short, strong,** and **hooked** to a sharp **point.**
(4) Similarly the **legs and feet of birds** differ very much, to **agree with their respective habits.**	,,	(4) *Briefly enumerate* (*with illustrations*)— (*a*) Birds of **prey** or **seizers** have **powerful, sharp, hooked talons** (three in front, one behind). (*b*) **Perching** birds have **three long, slender, jointed toes in front and one behind** (sparrow, canary).

		(*c*) **Climbing** birds have **two toes in front and two behind** (parrot, woodpecker). (*d*) **Scratching** birds have short, **thick, coarse toes and blunt nails** (fowls, turkeys). (*e*) **Wading** birds have **stilt-like legs** and **slender, spreading toes** (heron, stork). (*f*) **Swimming** birds have **web or skin stretching between the toes** (duck, goose). (*g*) **Running** birds have only **two short, thick toes, pointing to the front** (ostrich).
(5) Birds have a **keen sight.**	,,	(5) *Refer* to eyes of **soaring birds**, able to **face** the fierce glare of the **sun**; and to **homing propensity** of pigeons being probably due to a **far-reaching sight** recognising familiar objects in the distance. *Describe* a "**bird's eye view**" of a landscape being so vastly different from ours.
(6) Birds have to travel great distances in their search for food, and hence their power of flight.	,,	(6) *Allude* to (*a*) **distance covered** by a sparrow **feeding** its young. (*b*) **distance travelled** by **migratory** birds between their summer and winter **feeding grounds.**

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.

XXVII.—HOUSE-FLY

Objects.—Wall-chart of House-fly, and Enlarged Diagram of the Parts; a few Preserved Specimens mounted on Cards, to pass round; a Living Fly in a Covered Glass. **Apparatus.**—A Glass of Clean Water and a Straw; a Sucker.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of a Fly. (1) The house-fly is a little **insect**, with its body "**cut into**" three parts—(*a*) head, (*b*) chest, and (*c*) belly.	Observation.	(1) *Class may be told* that **insect** means "cut into" three parts—every insect has these **three parts.** *Note* the **ash-coloured** body, joined by thin neck to the head, and to **pale abdomen speckled with black.**

Objects.—Wall-chart of House-fly, and Enlarged Diagram of the Parts; a few Preserved Specimens mounted on Cards, to pass round; a Living Fly in a Covered Glass. **Apparatus.**—A Glass of Clean Water and a Straw; a Sucker.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) It has six **legs,** in three pairs, **all jointed**; it can **walk** and **run,** but **not jump**; it **can walk** on a **smooth surface** like glass, or even crawl along a ceiling **upside down.**	Observation.	(2) *Tell* that **every insect has six legs.** *Count* the **five joints**; the last joint, called the **tarsus** or foot, may best be understood from the *enlarged diagram*—it has two **tiny claws,** and two **pads** furnished on the margin **with innumerable hairs,** each hair **kept moist** at the end by an exuding fluid. *Explain* that each hair **serves as a sucker,** while the pads protect the hook of the claws. *Experiment* with a boy's **leather sucker,** and, if possible, get a fly to walk upside down inside a covered glass vessel.
(3) It can **see so well** with its great eyes, that **it is difficult to catch** a fly.	Experiment, or Memory.	(3) *Remind* children of the difficulty of catching a fly with the hand—*mimic* the attempt and the **escape of the fly.** *Point out* the **two large eyes** at the side of the head.
(4) For a **mouth** it has a **little trunk** or tongue.	,,	(4) *Show this part on enlarged diagram. Experiment* with a living fly in the glass, and *let a scholar tell class* what he observes when a lump of sugar is placed inside for the fly—it does **not eat the sugar,** but puts out its trunk, with which it **moistens and softens** the sugar and **then sucks it up.**
(5) In front of the head are also **a pair of short feelers.**	,,	(5) These (called antennæ) may be seen to be jointed, if *diagram* is on a large scale.
(6) The **chest** is in three **rings,** and on the upper side of the middle ring are a **pair of wings.**	,,	(6) *Observe* the ring-form. *Admire* the **delicacy and strength** of the almost **transparent wings.** [cate wings. *Note* the veined or branching **ribs** which **strengthen** these deli- A magnifying-glass, or even keen eyesight, will reveal the two **balancers or poisers** on the hindmost ring.
STAGE II.—Questioning on Foregoing Examination.		
(1) A house-fly is **an insect because it is divided into three parts,** the	Questioning.	(1) What is the **meaning** of insect?—("**Cut into.**") **Why** is the **house-fly** an insect?—(Because it is cut into three parts.) **Name the**

head, thorax, and abdomen, **joined by a filament.**

(2) On the three imperfect rings of the **chest or thorax** are the **organs of motion,** three pairs of **legs,** and a pair of **wings.**

(3) The **wings are delicate yet strong,** and they **beat the air so rapidly** that they make **a buzzing noise.**

(4) A fly **has five eyes;** two very large **compound eyes,** and three **smaller ones between them.**

(5) It has two very small brush-like **feelers** and a **trunk.**

A House-fly.

,,

,,

Telling.

Questioning.

Telling.

,,

,,

parts.—(Head, chest, and belly.) How do the three parts **seem to be joined together?**—(By a very **narrow thread.**)

Employ the simpler terminology.

(2) *How* do flies **move about?**—(Walk and fly.) **How many legs** have they?—(Six.) **Do flies walk** or **run,** or jump about?—(Walk and run, but **not jump.**) What enables a fly to **walk on smooth places,** or on a ceiling?—(**Little hairs** on the feet **acting as suckers.**) What can a house-fly do which is **much better than jumping** or hopping?—(**It can fly.**)

(3) When a house-fly is flying about **what can you hear?**—(A **hum.**) **What makes** that humming **noise?**—(Its wings.) Are they **thick or delicate** wings?—(Delicate.) Are they **thin enough to be seen through?**—(Almost.) What seems to run through the wings **to strengthen them?**—(**Branching ribs** like veins.) In **flying** do the **wings move** slowly or **rapidly?**—(Very rapidly.)

Mention that the wings are known to make **600 strokes a second,** and in a state of alarm, many times more, carrying this tiny creature at **the rate of a mile in three minutes.**

(4) Why is it **difficult to catch** a fly?—(It can **see so well.**) **How many eyes** can you **see** on its head?—(Two large ones.)

Inform that these two are called compound eyes, because they are **composed of 4000 lenses each;** while between them, in front of the head, are **three small simple eyes.**

A Fly's Compound Eye (much enlarged).

(5) **What else has the fly upon its head?**—(Two feelers and a trunk.) What is the **use of this trunk?**—(It is its **mouth.**) When **you eat a lump of hard sugar,** what do you bring into **use?**—(**Jaws and teeth.**) But if the **fly has neither jaws or teeth,** how does it manage to eat sugar?—(**It drops a spot of moisture** from its trunk **to soften it,** and then begins to suck it.)

Explain that most **sweet things,** such as flies like to eat, have **much fluid or watery matter** which can be sucked up.

Illustrate by sucking water **through a straw.**

HOUSE-FLY—*Continued*

Objects.—Wall-chart of House-fly, and Enlarged Diagram of the Parts; a few Preserved Specimens mounted on Cards, to pass round; a Living Fly in a Covered Glass. **Apparatus.**—A Glass of Clean Water and a Straw; a Sucker.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE III.—Structure and Habits.		
(1) The **life-history** of a fly is—	Telling.	(1) This step *may be reserved for a separate Lesson* on insect development; in any case, it needs specimens or enlarged diagrams.
(*a*) A tiny **egg**, eighty of which the mother-fly **lays in dead flesh.**		(*a*) **Flesh** is selected **because it forms the food** of the larva or grub.
(*b*) **A maggot**, or small white grub, which **eats day and night** till of **full-size**, when a hard **case is formed** outside it.		(*b*) *Count* **thirteen body rings**, the **first** of which forms the head with **a pair of jaws.** *Note*, in a living maggot, **power to move slightly**, but without visible legs.
(*c*) A chrysalis or **pupa** which never moves, eats, or grows; yet **inside great changes go on**, body, legs, and wings being formed there.		(*c*) *Compare* **pupa** with **cocoon of silkworm**—the term **chrysalis** is generally applied to butterflies in the pupal stage, because they are adorned with "golden" tints.
(*d*) A perfect insect, or **imago**, which **cracks the hard case**, creeps out, unfolds its crumpled wings, begins its **real fly** life.		(*d*) *Describe* utter **weakness** of the newly-emerged insect, so **soft and tender** at first, but **soon acquiring strength** and firmness, and flying off to begin the **business of life**, which seems to be **chiefly the laying of eggs** before overtaken by an **early death.**
(2) The fly belongs to the "**two winged**" **insects**, yet every insect should really have four wings.	,,	(2) *A magnifying-glass will reveal*, in place of hind-wings, **two little balancers**, short stalks terminating with little knobs; **if these are damaged** the fly flutters helplessly and **cannot fly properly** at all. Balancers are **substitutes for wings.**
(3) The fly **breathes by small holes** or openings **in the side** of its body.	,,	(3) These are the openings of little **breathing pipes**, which are **kept open by spiral springs** like an indiarubber garden hose lined with coiled wire. *Contrast* with our lung breathing: say that if a fly fell into some oil, or **anything which would stop up its air holes**, it

		would **choke to death**, just as we would if our mouth and nostrils were stuffed up.
(4) **Flies have nerves**; they can feel, see, and smell.	,,	(4) *Inculcate* the duty of **refraining from cruelty** even to these small and **insignificant creatures.**
STAGE IV.—Uses of Flies in Nature.		
(1) In the grub state they **eat up dead carcases** which might otherwise decay and poison the air.	Telling.	(1) *Gather* that decaying meat stinks, and that **bad smells** are not only **offensive**, but **breed disease.**
(2) As flies **they collect and devour tiny creatures in the air, which are injurious** to human health.	,,	(2) *Remind* of flies **whirling in the air**—*inform* that they are collecting tiny creatures contained in the air (**animalculæ and micro-organisms**), but which cannot be seen; and when **a fly is seen cleaning itself** with two front legs, it is really transferring these creatures from the outside of its wings, legs, and body, to the inside of its stomach.
(3) Flies **form the food of birds**, spiders, and other animals.	,,	(3) *Note* that being a **summer creature**, it can therefore **only be preyed upon in the warm season.**

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.

XXVIII.—TAILS AND THEIR USES

Objects.—A Live Dog. Prepared Tail Bones (as of Cow); Brushes of Fox and Squirrel; Pictures of the various Animals whose Tails are dealt with.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Tails.		
(1) **Few animals** seem to be **without tails.**	Observation.	(1) *Mention* the **guinea pig** as a **tail-less** animal.
(2) Some tails are **thick**, warm, **bushy fur.**	,,	(2) *Show* **brushes** of **fox** and squirrel, and *picture* of collie dog.

TAILS AND THEIR USES—*Continued*

Objects.—A Live Dog. Prepared Tail Bones (as of Cow); Brushes of Fox and Squirrel; Pictures of the various Animals whose Tails are dealt with.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) Some are **bunches of coarse hair.**	Observation.	(3) *Show* picture of **horse.** *Exhibit* some horse-hair.
(4) Some tails are **bony and strong.**	,,	(4) ,, ,, **cow**, and *exhibit* prepared **tail-bones**; also picture of **kangaroo.**
(5) Some tails are **thin and fleshy.**	,,	(5) ,, ,, **rats** and mice (long), and contrast with tail of **pig** (short and curly).
(6) Some are covered with **long hair all the way along**, and some are only **tufted at the end.**	,,	(6) ,, pictures of **cat** and of **lion**, and *contrast* the tails.
(7) Some tails **can grasp.**	,,	(7) ,, ,, **monkey** and **harvest mouse.**
(8) Some tails **are very short.**	,,	(8) ,, ,, **deer** and **rabbit.**
(9) The **tails of dogs vary** much in size and shape, but **all turn up a little** at the tip.	,,	(9) ,, ,, dogs, and *contrast* tails of **collie** and **grey-hound.**
		Induce the living dog to **wag his tail in pleasure** by patting, or feeding him.
STAGE II.—Questioning on Foregoing Examination.		
(1) It is **exceptional** for an animal to be **tail-less.**	Questioning.	(1) *Tell* me the names of **animals which have tails.** Now tell the names of as many which **have no tails.**—(By the attempted *enumeration* of the latter, *prove how exceptional* they are.)
(2) The tails of animals **vary** in **size**, in **shape**, and in **texture.**	,,	(2) Name to me an animal with a tail of warm, bushy fur.—(**Squirrel.**)
		,, ,, ,, a tapering tail covered all along with fur.—(**Cat.**)
		,, ,, ,, a tail of bunched coarse hair.—(**Horse.**)

		,, ,, ,, a bony tail, tufted at end.—(**Donkey, cow.**) ,, ,, ,, a bony tail which can hold or grasp.—(**Monkey.**) ,, ,, ,, a thin and fleshy tail.—(**Rat.**) ,, ,, ,, a very short tail.—(**Hare, stag.**)
	Memory.	What **kind** of tails have **dogs?**—(**All shapes and sizes.**) What did the **dog do with its tail** to show it was pleased?—(**Wagged** it.) What does a **cat sometimes do with her tail** to show she is angry?—(**Lashes** it.)
STAGE III.—Tails and their Uses.		
(1) Tails are sometimes used to **express feeling.**	Questioning.	(1) How could you tell if I was **pleased?**—(**Smile**—by the face.) And if I were **angry?**—(**Scowl**—by the face.) How did the **dog show pleasure?**—(By wag of the tail.) How does a cat or **lion show anger?**—(By lashing the tail.)
(2) Tails are sometimes used as **fly-flippers.**	,,	(2) If a horse, or a cow, or a donkey is **troubled by the flies** in summer, how does it attempt to **get rid of its tormentors?**—(Flicking the tail.)
(3) Tails are sometimes used as **wrappers for warmth.**	,,	(3) When the **cat** lies down to **sleep,** where does she put her tail?—(**Curls it round her.**) When the **squirrel** settles down to its **long winter sleep,** what serves as a blanket to keep it warm?—(Brush.)
(4) Tails are sometimes used as **rudders.**	,,	(4) How is a boat or a **ship made to turn?**—(By a rudder.) With what do **fishes turn** themselves, as with rudders?—(Their tails.) What do you think **assist birds to steer** themselves through the air?—(Their tails.) Suppose a **land animal** takes to the water regularly, as a **water-rat** does, what do you think it **uses to steer** through the water?—(Its tail.)
	Telling.	*Mention* the **flying squirrels,** which jump long distances through the air, and **use their big tails to steer with.**
(5) The **kangaroo** uses its tail as **an extra leg.**	,,	(5) *Exhibit* a picture of a **kangaroo** sitting up, or **springing** with the help of its powerful tail. **Rats** also spring with the aid of the tail.

TAILS AND THEIR USES—*Continued*

Objects.—A Live Dog. Prepared Tail Bones (as of Cow); Brushes of Fox and Squirrel; Pictures of various Animals whose Tails are dealt with.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(6) A few animals have **prehensile** ("taking hold") **tails**, and use them as hands.	Telling.	(6) *Tell* how some tails seem to have the **sense of touch**, how they are very **flexible** ("easily bent"). *Instance* the strong, **muscular tail** of the **monkey** with which it **clasps** and hangs its whole weight upon for hours at a time; the **underside of the tip** being devoid of hair, and **sensitive** to the touch **as a finger**—the monkey is **not obliged to turn round** to see where to grip. The **harvest mouse**, smallest of English quadrupeds, can also **twist its tail** round the stalks of grass or corn, to enable it to **glide safely** from its **nest** at the top of the stalk **to the ground**.
(7) Tails assist in the **classification of monkeys**.	,,	(7) *Point out* the **importance of tails** when they assist in the **classification** of **monkeys**; those without tails being called **apes**, and those with short, insignificant tails being called **baboons**.
STAGE IV.—Conclusion.		
(1) All animals which have **well-developed** ("well-grown") **tails**, seem to **have a particular use** for them.	Telling.	(1) *Let class name* an animal with a **tail**, and **state the use** of it—this will serve as a recapitulatory exercise.
(2) Those animals which are **tail-less**, seem to be so **because they have no special need of tails**.	,,	(2) *Show* that the **elephant** and the **pig** have very **thick skins**, and that flies are **not** able to **penetrate** them, and **therefore** the **tails** of these creatures are **insignificant**. Similarly, the **sheep** is **protected** from flies by the **thickness of the wool**, and hence the **tail is not needed** as a fly disperser, **as it is with the cow**.

Review by Recapitulatory Questioning to bring out Salient Points in Each Stage.

1. A Monkey's Tail. 2. A Kangaroo's Tail. 3. A Cow's Tail.
4. A Sheep-dog's Tail. 5. A Fox Terrier's Tail. 6 A Squirrel's Tail.

XXIX.—COVERINGS OF ANIMALS

Objects.—A Fish ; a piece of Snake's Skin, or Picture of Snake ; a Dead Bird ; Specimens of Fur and Hide with Hair on ; Picture of Hedgehog and some Porcupine Quills ; a Frog ; a Picture of Tortoise.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Objects.		
(1) Fishes and snakes are covered with **scales.**	Observation.	(1) *Scrape* some of the **scales** from the **fish**, and *pass* the scales *round* on *Point out* the **scaly** nature of the **snake skin.** [the plate.
(2) Birds are covered with **feathers.**	,,	(2) *Pluck* a few **feathers** from the dead bird, and *pass them round* on the same plate as the bird.
(3) Some animals are covered with—	,,	(3) (*a*) *Exhibit and name* specimens of **fur.** A **cat** may be brought in to stroke.
(*a*) **Soft fur.**		(*b*) ,, ,, ,, **hair on hide**—of cow or horse.
(*b*) **Hair.**		(*c*) ,, ,, ,, **wool on skin.** *Compare* texture of parchment and leather.
(*c*) **Wool.**		(*d*) ,, ,, ,, **pig's bristles.** *Show* a bristle brush.
(*d*) **Bristles.**		(*e*) ,, ,, ,, **porcupine quills.** *Show* picture of hedgehog.
(*e*) **Spines.**		
(4) Some creatures, as the frog and toad, are **quite naked.**	,,	(4) *Exhibit* a frog, and *let* its **moist cold skin** *be felt.*
(5) Some creatures have a **horny shell** on their backs.	,,	(5) *Exhibit* picture of **tortoise**, pointing out its head, tail, and limbs. *Show* a piece of **tortoiseshell.**
		[Avoid dealing with any creatures other than those possessing an internal skeleton—what the children call "shell-fish" will therefore not fall within the scope of this Lesson.]
STAGE II.—Questioning on Foregoing Examination.		
(1) **Scales** are small horny **plates** attached to the body in front, with loose **overlapping edges** behind.	Questioning.	(1) **When you stroke** your fingers over a fish, what do the **scales feel like?**—(Little horny plates.) But if you **rub your finger** along **the other way,** what do you notice about the scales?—(**Loose edges.**) Are the **scales fixed in front** or behind?—(In front.)
	Comparison.	*Compare* overlapping edges with a **tiled roof.**

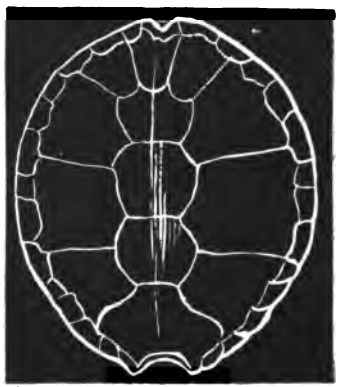
(2) **Feathers** are soft, light, and warm.	Questioning.	(2) With what are **birds covered**?—(Feathers.) What do you **notice** about the **weight of feathers**?—(Very light.) Are they harsh and stiff, or **soft and easily bent**?—(Soft.) Do they make a **warm covering**, or are they cold as well as light?—(Warm.)
(3) Of the **hairy coverings** of animals, the finest and softest is called **fur**, and the thickest and coarsest are **bristles**; very thick and strong bristles are called **spines**; a covering of fine, thick, curly **hair, which crinkles** into a mass is **called wool.**	,,	(3) Of the hairy coverings, what do we call the **softest kind**?—(Fur.) And the **hardest kind** of hairs?—(Bristles.) What are **even thicker** and harder for a covering **than bristles**?—(Spines.) What do we call a very fine, thick, and **curly kind of hair that grows in a mass**?—(Wool.) *Let* an animal or two *be identified* with **each kind of covering** as it is named and described.
(4) Frogs and toads have a **moist, naked skin.**	,,	(4) How do frogs and toads **feel to the touch**?—**(Cold and moist.)**
(5) Tortoises have **large shells**, under which they can **shield themselves** from danger.	,,	(5) If you **looked down on a tortoise**, would you **see** much or little beyond its hard shell?—**(Little.)** Why do **soldiers** sometimes carry **shields**?—(To **protect the body**.) Why do you think the **tortoise is provided** with a hard shell?—(As a **shield to cover softer parts** of the body.) Will **those parts protrude** or "stick out" little or much?—(The head and legs stick out **very little.)**

STAGE III.—Suitability of Coverings to Habits.		
(1) **Scales** form a **smooth and flexible** ("easily bent") **covering** on a **fish** for passing through water.	Questioning.	(1) What do you feel **on the scales** of the fish?—(Slime—**oily fluid.)** Would that **make it easier** or more difficult for **getting through the water**?—(Easier—because slippery.)
On a **snake** they **permit locomotion** ("moving from place to place"), and **even climbing**, to the limbless animal.	Telling.	*Infer* the **difficulty of progression** if fishes were covered with anything **not smooth**—as wool, for instance. *Demonstrate* **flexibility** afforded by the **arrangement of the scales.** *Note* that there is **variety** in the **form** and **size** of **scales.** *Describe* how **scales** on a **snake** allow it to **hitch itself along**; and also **allow of the distension** of the body when **prey is swallowed whole.**
(2) **Feathers**, being **soft, light, and warm**, are the **best** form of covering **for birds.**	,,	(2) *Show* that **scales** might be **flexible** for every movement of the body; and also so **smooth** that they would **not impede progression** through the air; **yet** they would **not be warm**

COVERINGS OF ANIMALS—*Continued*

Objects.—A Fish ; a piece of Snake's Skin, or Picture of Snake ; a Dead Bird ; Specimens of Fur and Hide with Hair on ; Picture of Hedgehog and some Porcupine Quills ; a Frog ; a Picture of Tortoise.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		enough for birds. *Prove* that **feathers** are the lightest, softest, and warmest **of all possible coverings**—for **fur** might be **soft and warm**, but **scarcely so light**, nor so **smoothly set for passing swiftly through the air.**
(3) **Most animals** are covered with **hair in some form** ; if it is **thick**, it is needed for **warmth** ; if it is **thin**, the animal has a very **thick skin**, and does **not need** much **hair.**	Telling.	(3) *Let class enumerate* the **hair-covered animals** they know. *Instance* the thick **furs for warmth**—squirrel, bear, fox. *Instance* the **fewness of hairs** or bristles **on thick skin** of pig and elephant.
(4) The **covering** of some animals is their **only means of defence.**	,,	(4) *Gather* that the hedgehog and porcupine have **quills**, and the tortoise and turtle have **shells, as protections** against the foes they are **not swift enough to escape.** *Note* the **strength** of these **shells**, and the **weight** they can **support.**
(5) Frogs and toads are **naked**, because they have to **breathe through their skins.**	,,	(5) *Tell briefly* how these creatures have **no ribs to expand** when they breathe in, and so **simply swallow the air**, and then take in **additional air through the skin**, which must be **kept moist.**



A Turtle Shell.

STAGE IV.—Man wears Clothes. (1) Man wears **clothing** to keep him **warm.**	Telling and Questioning.	(1) *Briefly gather* that man has **no natural covering** outside his skin—that he needs and is **clever enough to make** himself **clothing.**
(2) **Much of the clothing** we wear has **already** been **worn by some animal.**	,,	(2) *Gather* from the children some of these animal coverings **transferred** to the body of man, as— **Furs (trimmings** or **boas).** **Feathers** (,, ,,). Leather (boots). Kid (gloves, shoes). Woollen clothing. *Note* that **wool** may be taken from the sheep **without killing** it— **Alpaca.** **Mohair (braid).**

XXX.—USES OF ANIMALS

Objects.—As many Animal Products as are procurable, such as Bristles, Cat-gut, Feathers (for stuffing, for trimming); Hornware (combs, buttons, handles); Boneware (buttons, egg-spoons); Horsehair (woven, and for stuffing); Ivory; Parchment; Pearl; Furs (various); Tallow; Wax (bees'); Whalebone; Oil (animal); Silk. Pictures of Animals at Work for Man.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Objects and Pictures. (1) There are almost countless **materials obtained from animals** which we use— (*a*) In **clothing** ourselves.	Observation.	(1) *Announce* the intention of endeavouring to *find out* **how much we owe to animals.** (*a*) *Let the children sort out*, at the same time *thoroughly handling* the objects, first those used in **clothing**; as trimming feathers, horn buttons, bone buttons, furs, whalebone (corset), and any others available.

USES OF ANIMALS—*Continued*

Objects.—As many Animal Products as are procurable, such as Bristles, Cat-gut, Feathers (for stuffing, for trimming); Hornware (combs, buttons, handles); Boneware (buttons, egg-spoons); Horsehair (woven, and for stuffing); Ivory; Parchment; Pearl; Furs (various); Tallow; Wax (bees'); Whalebone; Oil (animal); Silk. Pictures of Animals at Work for Man.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		Order the class to point with their fingers to any article of **their own clothing** they owe to the **cow** (their leather shoes), to the **sheep** (woollen garments), **silkworm** (ribbon), **wild animals** (furs, felts), **birds** (feather trimmings).
(*b*) For our **food.**	Questioning.	(*b*) *Enumerate* **food products**, *teacher suggesting the animal*, as **cow** (beef, cheese), **bee** (honey); then name **game, poultry, fish.**
(*c*) To make **furniture, implements,** and other articles.	Questioning and Observation.	(*c*) *Let the objects be sorted*, and at the same time *well handled;* as **(for furniture)** horsehair, mother-of-pearl, ivory, and horn handles of knives; **(for implements of use)** bristle brush, tortoise-shell comb, bone egg-spoon; **(for trinkets,** &c.) horn snuff-boxes; **(for musical instruments)** cat-gut and parchment.
(*d*) In **manufactures.**	,,	(*d*) If the objects are present *ask for them under heads* again; thus, "Show me something we use to make **candles (wax), soap (tallow),** to make **machinery** run smoothly **(train oil),**" and so with whatever objects are present.
STAGE II.—Questioning on Foregoing Examination.		
(1) Animal products of all kinds are in **daily and constant use** around us for a **variety of purposes.**	Questioning.	(1) *Take up each object* in turn, hold it well *in view of the whole class,* and *ask*— What is the **name** of this? What is it **used for?** From **what animal** is it obtained? From **what part of the animal?** **How** is it **obtained** or **prepared?**

		Ensure at this stage *that the pupils know* (*a*) the **name**, (*b*) **use**, (*c*) **animal from which derived**, (*a*) the **part of the animal**, and (*e*) the **method of obtaining** and **preparing** each product exhibited—*all summarily and briefly.*
(2) The **useful animals** already named may be **grouped** into classes; as	Questioning.	(2) *Work out fully a series of questions* on the following lines—
(*a*) Those which supply us with **food.**		(*a*) What **animals provide** us with **food?**—(Cow, sheep, pig, poultry, game, fish.)
(*b*) Those which supply us with **clothing.**		(*b*) What **animals provide** us with **clothes** or **material** to make clothing?—(Cow, sheep, silkworm.)
(*c*) Those which supply us with **materials** used in **manufactures.**		(*c*) Name some **animals and their products** used in **making things.**—(Bees give wax to make candles.)
(*d*) Those which supply us with several **useful products.**		(*d*) What **article of food** is given to us by the cow?—(Beef.) And what **article of clothing?**—(Leather.) And what **article used for making** soap?—(Tallow.)
STAGE III.—Expansion of the Foregoing Information.		
(1) Other animals are **useful** to us **in other ways**; as		(1) *Build up* a further knowledge of the subject by *piecing together the children's collective knowledge.*
(*a*) Animals that **work for us** in a variety of ways.	Questioning.	(*a*) What animals **carry us**, or **drag loads** for us?—(Horse and ass at home; elephant and camel abroad.)
		What animal **helps the shepherd** to mind his sheep?—(Dog.)
		What animals **keep away** other useless and **destructive creatures?**—(Dogs prevent rats, cats keep away mice and other vermin.)
	Telling.	*Make a passing allusion* to **creatures** that often **benefit us without our knowledge**: as flies which purify the atmosphere, insects and grubs which eat up decaying filth.
(*b*) Animals that assist **in our sports.**	Questioning.	(*b*) What **animal** do we employ when we wish to **ride** or **drive** or **travel** for pleasure?
		What do **huntsmen have to** carry them more swiftly than they could themselves **chase the game?**—(Horses.)
		What other animals are employed to **scent out the game** and to **catch it?**—(Dogs.)

USES OF ANIMALS—*Continued*

Objects.—As many Animal Products as are procurable, such as Bristles, Cat-gut, Feathers (for stuffing, for trimming); Hornware (combs, buttons, handles); Boneware (buttons, egg-spoons); Horsehair (woven and for stuffing); Ivory; Parchment; Pearl; Furs (various); Tallow; Wax (bees'); Whalebone; Oil (animal); Silk. Pictures of Animals at Work for Man.

MATTER.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*c*) Animals that **add to our pleasures** in other ways.	Questioning.	(*c*) To **please the ear** what little creatures do we often **keep in cages?**—(Canaries and other singing birds.) What **other birds** are sometimes kept to **please the eye** by their bright colours and beautiful forms?—(Parrots, peacocks.) What **large animals** are kept solely for **ornament** in large parks?—(Deer.)
(2) Some animals are kept by man as **companions** or as **pets.**	,,	(2) Some dogs may be kept for **hunting**, some for **guarding** our property, and some for **shepherding**; but why do so many of us keep dogs in our houses?—(**For company**—as companions.) And why do we keep such creatures as **gold-fish, doves, white mice,** and guinea-pigs?—(As **pets.**)
	Telling.	*Name some other creatures* kept as companions or as pets.
STAGE IV.—Conclusion. (1) Some animal **products** we get **direct** from the animal, and **some after preparation.**	Memory and Questioning.	(1) *Class to name* **direct** products, as beef, pork, honey: the **indirect products from some creatures**, as tallow, lard, wax-candles.
(2) Some animals **yield useful products while alive**, and some only **when dead.**	,,	(2) *To name* **first products (alive)**, as milk, butter, eggs, wool; the **second (dead) products**, as meat, poultry, furs.
(3) Some animals are **so useful that we keep them tame**, while **others** we have to **hunt for.**	,,	(3) *To name* **domestic animals**, and as many **wild animals, birds,** and **fishes**, as average *children are acquainted with.*

PART II

I.—CAT AND DOG COMPARED

Objects.—A Cat and a Dog in separate baskets.

MATTER SUMMARISED.

STAGE I.—Examination of the Cat.

(1) The **feet** have soft fleshy **pads:** the **toes** are used **for walking upon,** the **heel** part being **raised.**

(2) There are five **hooked claws** on each fore foot, and four on each hind foot: they work in and out of **sheaths.**

A Cat's Tongue.

(3) The **body** is **slim,** the **head round,** and the **tail long.**

(4) The **eye** is round, but the **pupil varies** according to the amount of **light.**

(5) The **teeth** are **long and sharp.**

(6) The **tongue** is **dry and rough.**

(7) The **fur** is **soft, thick,** and **smooth.**

DETAILED HINTS AND SUGGESTIONS.

By Observation and Experiment.

(1) *Observe* pads, toes, and **elevated heel** part.

(2) *Feel* the claws. *Experiment* by offering the cat something for her **to clutch at.**

A Cat's Mouth.

(3) *Let* **weight** of cat *be felt* to note its **lightness**—its slimness being hidden by thick fur.

(4) *Experiment* by holding cat to the full **light of the window,** to see pupils close to mere lines; then take cat into **darkest corner** to note the dilation of the pupils.

(5) *Open* the cat's mouth and *display* **pointed teeth.**

(6) *Let* tongue *be felt,* **drawing finger** from the root **towards the tip.**

(7) *Stroke* the cat and **bury fingers** in thickness of the fur.

A Cat's Foot.

A Cat's Foot: claws extended.

A Cat's Eye by Day.

A Cat's Eye at Night.

STAGE II.—Examination of the Dog.

(1) The dog has **same number of toes** as cat has claws, and set on **pads**: but they are **blunt**, and **not** sharp, long, and **curved**; **nor** do they draw in and out of **sheaths.**

A Dog's Foot.

(2) The body is more **solid and weighty**, the head **elongated** at the **nose**, and the **tail varies** in length and shape according to **breed.**

(3) The **eye** is set **prominently**, but the **pupil** does **not open and close.**

(4) The **teeth** are long and sharp.

(5) The **tongue** is wet and smooth.

(6) The covering is **hair**, which varies in texture according to breed.

STAGE III.—Comparison of the Cat and the Dog.

(1) In **form**, cat and dog are **alike** in respect of—

(*a*) Number of **toes.**

(*b*) Padded **feet.**

(*c*) **Teeth** formation.

By Observation and Experiment.

(1) *Count* the 5 and the 4, *feel* the **bluntness**, and *observe* that there are **no sheaths** (non-retractile)

Skull of the Dog.

(2) *Feel* the **weightier solidity.** *Note* the **pointed muzzle.** *Memory* will *recall* **various** shapes of **tails** in dogs of **different breeds.**

(3) *Observe* prominence at the **sides of the head.**

Experiment, as with the cat, and show the **light does not influence** the pupil.

(4) *Observe* similarity to cat's.

(5) *Experiment* by inducing the dog to **lick the hands** of several scholars.

(6) *Feel* the **coarser quality** of dog's covering.

By Questioning, Telling, and Comparison.

(1) *Announce intention to discover* likeness and unlikeness in form, habit, and uses.

(*a*) How many **toes** has a **cat?** How many has a **dog?**

(*b*) How are the **feet** of the cat and of the dog **formed** for **noiseless approach** to their prey?—(Padded.)

(*c*) How are the **teeth** of both animals formed for **cutting and tearing flesh?**—(Long, and sharp or pointed.)

CAT AND DOG COMPARED—*Continued*

Objects.—A Cat and a Dog in separate baskets.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(2) In **form**, they are **unlike** in respect of—	(2) *Take* differences in *same order*.
(*a*) Toes of cat have sharp **claws**, but dog has **blunt nails.**	(*a*) How do the **nails** of a cat **differ** from those of a dog?—(Long, sharp, and curved.)
(*b*) The cat's claws draw in and out of **sheaths.**	(*b*) When do the cat's **claws appear longer?**—(When outstretched for **clutching.**) When do the same claws **appear no longer** than the dog's blunt nails?—(When **at rest.**)
(*c*) The cat's **head is round**, but the dog's **head is elongated** at the nose.	(*c*) Which **head** is round as an **apple?**—(Cat's.) And when drawn out like a **pear?**—(Dog's.)
(*d*) The cat's **eye adjusts** itself to the amount of light; the dog's eye does not, but it is **more prominent.**	(*d*) Which animal seems to have its **eyes** best set for **seeing all round** when hunting and running fast?—(Dog.) Which animal has **eyes** that show themselves **in the dark?**—(Cat.)
(*e*) The cat has a dry, **rasping tongue**; the dog's tongue is **smooth and wet.**	(*e*) Suppose a cat and a dog **both licked** your hand in the dark, how could you **tell one from the other?**—(The cat's tongue would feel dry and rough, the dog's wet and smooth.)
(*f*) The cat is covered with **fur**; the dog is covered with **hair.**	(*f*) If you **felt the coat** of a cat and then that of a dog **in the dark,** how could you tell which was the cat?—(The cat's **fur** would feel **softer than the hair** of the dog.)
(3) In **habit**, the cat and the dog are **alike** in respect of—	(3) *Announce* that habits or "ways" will now be dealt with in the same way.
(*a*) Both are **flesh-eaters.**	(*a*) *Infer* from **teeth formation, jaw movements,** and **bolting of food.**
(*b*) Both have **keen sight, scent, and hearing.**	(*b*) *Question* on **qualities** needed by **hunting animals.** *Note* dog's **keener scent** and cat's **nocturnal sight.**
(*c*) Both are **toe-walkers.**	(*c*) *Contrast* with **sole-walkers** (Man, Bear).
(4) In **habit**, the cat and the dog are **unlike** in respect of—	(4) *Ask for* difference of habit now.
(*a*) The cat is **scentless**; but dogs have a peculiar **odour.**	(*a*) Why are **dogs** found **unpleasant** when they lie in front of a **warm fire?**—(Their odour is strong.) If the **mouse** could

smell the cat waiting for it **outside its hole,** what would it **never** do?—(**Come out.**)

(*b*) Which animal hunts its prey by **patient watching**?—(Cat.) Which goes **after its prey noisily**?—(Barking dog.) Which animal has **eyes** for hunting at **night time**?—(Cat.)

(*b*) The cat is **lithe and stealthy**; the dog is more **alert, active, noisy, and enduring.**

Explain that the **wide-open pupils admit** whatever **light** there may be, and **reflects it** from the back of the eye—hence the **blazing eyeballs.** *Illustrate* by the opening and closing of window **curtains** for **admitting and excluding sunlight.**

Contrast **climbing powers** of cat with the **enduring powers** of hounds in the chase.

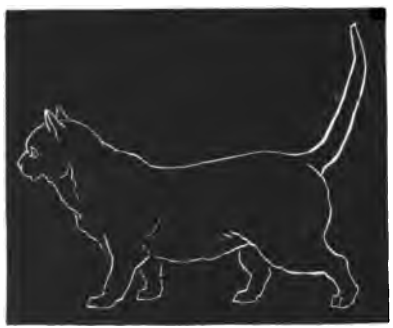
(5) The cat is **used** chiefly as a domestic **pet**; but man has made the dog **useful** in **many ways.**

(5) *Contrast* the **attachment** of the cat to a **house,** and that of the dog to a **person.**

Let class enumerate some **uses** made of the **dog—**

(*a*) In hunting.
(*b*) Shepherding.
(*c*) Watching.

Recapitulate for Chief Points in the Lesson. See Lessons I. and II. of First Series.



Outline of a Cat.

A Dog's Head.

II.—BREEDS OF DOGS

Objects and Apparatus.—Any Two Dogs of Different Breeds (Pups, in a basket); Pictures of Various Breeds (to same scale).

MATTER SUMMARISED.

STAGE I.—Observation of Specimens and Pictures.

(1) **All dogs** have a **common nature**—they are all **teachable, affectionate,** and **faithful.**

DETAILED HINTS AND SUGGESTIONS.

By Observation and Experiment.

(1) *Ask* what the living specimens are, and what pictures represent—by **ready response** *show* that it is **difficult to mistake** a dog for any other creature, however much dogs may vary.

Exercise memory on **common traits** of docility, affection, and fidelity; or *apply tests* to the living dogs to **prove these qualities**—for *instance*, that they never bear **malice.**

A Spaniel.

A Pointer.

(2) There are **different breeds** which are distinctively **marked by some modification** (not a complete change) in—
(*a*) **Form,** or feature development.
(*b*) **Size.**
(*c*) **Colour.**

(3) Beyond their common dog nature, **certain kinds** possess an instinct and a **character peculiar to** their own **particular breeds.**

(2) *Ask* for **variations** or alterations *to be pointed out* on pictures and specimens: as—
(*a*) In the **tails** of a collie and a greyhound; varying length of **muzzles**; texture of **hair,** &c.
(*b*) In **sizes** that vary from **toy dogs** to the noble Newfoundland.
(*c*) **Colours,** *children to name* as they point them out.
Claim a common relationship with each other for all of them.
Compare **dog nature** with human nature—there are races of white men, black men, &c.
(3) *Experiment* to show the common nature—please the living dogs to make them **wag their tails** with pleasure; scold them to show they have a conscience, acknowleding reproof by **hanging the head** and **putting tail between the legs.**
Explain **instinct** to be "animal sense," or "something which makes them do a thing without having to learn how"; for example, dogs **recognise** persons **by scent**; they instinctively **hunt** and **chase** animals such as **vermin and game.**
Now *promise* the class that an **attempt** is about to be made **to classify** dogs according as **each kind** or breed possesses **some characteristics peculiar** to itself.

STAGE II.—Some Breeds of Dogs.

(1) **Hounds** are **hunting dogs**; with—
(*a*) Forms **robust** and strong.
(*b*) **Muzzles** long and large.
(*c*) Large pendent **ears.**

All speedy, and their work is—

(*d*) To **find out** the game.
(*e*) To **run it down** and catch it.
(*f*) To **fetch it** (retrieve) after it is killed.

H

By Questioning, Telling, and Comparison.

(1) (*a*) *Educe*—for **endurance** in the **chase.**
(*b*) ,, for grasping and **killing the game.**
(*c*) ,, to act as an ear trumpet in **gathering sounds** of the **flying quarry.**
Surmise that dogs are more speedy now forests are cleared than when **first utilised by savage man.**
(*d*) *Educe*—by **scent** (or sight).
(*e*) ,, the **necessity of speed** and endurance.
(*f*) ,, the name retriever; tell how **tenderly** they **mouth the game,** and never devour it as their savage instinct might prompt.

BREEDS OF DOGS—*Continued*

Objects and Apparatus.—Any Two Dogs of Different Breeds (Pups, in a basket); Pictures of Various Breeds (to same scale).

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(2) Among the **varieties** of hounds there are the—	(2) *Ask* for as many varieties of hunting dogs as the *children can name.*
(*a*) Staghound.	(*a*) *Connect* name with work—hunting the stag.
(*b*) Foxhound.	(*b*) ,, ,, ,, fox. **Similar** in **form**,
(*c*) Harrier.	(*c*) ,, ,, ,, hare. but **not** in **size**.
(*d*) Beagle.	(*d*) ,, ,, ,, hare.
(*e*) Pointer.	(*e*) ,, ,, —**point with their noses** to where feathered game is lying hidden.
(*f*) Setter.	(*f*) ,, ,, —indicate position of the game by **setting** or crouching **towards it.**
(*g*) Bloodhound.	(*g*) ,, ,, —**scenting blood**, as in tracing slaves or sheep-stealers.
(*h*) Spaniel.	(*h*) *Connect* name with place of origin—Spain. Distinguish spaniel by **long silky hair**, large forehead, long ears. All varieties are **good-looking and intelligent**, and become **favourite** house dogs, though **originally** hunting, swimming, and retrieving dogs.
(*i*) Retriever.	(*i*) ,, work—retrieving or fetching game **killed by the sportsman.**
(*j*) Greyhound.	(*j*) ,, work and colour—hunt **by sight** and not by scent. *Dwell on* other peculiarities of this hound—its **slight and elegant form**, long sharp muzzle, narrow erect ears, deep chest, and slender legs, hair sometimes smooth and sometimes wiry. *Tell* that greyhound is supposed to have **descended** from a noble **breed of wolf hounds**, to which belonged the famous "Gelert" of the poem.
(3) **Water dogs** are the various kinds which are **better adapted** for swimming, although most dogs will take to the water: as—	(3) *Disapprove* of the **cruelty** of thoughtless people who **force unwilling dogs** into cold water.

(*a*) The sporting **spaniels.**

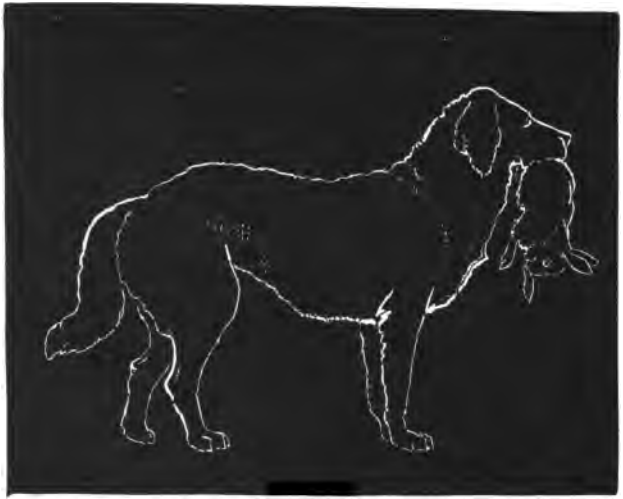
(*b*) **Poodles,** also of the spaniel kind.

(*c*) The **Newfoundland** dog, the largest of all water-dogs.

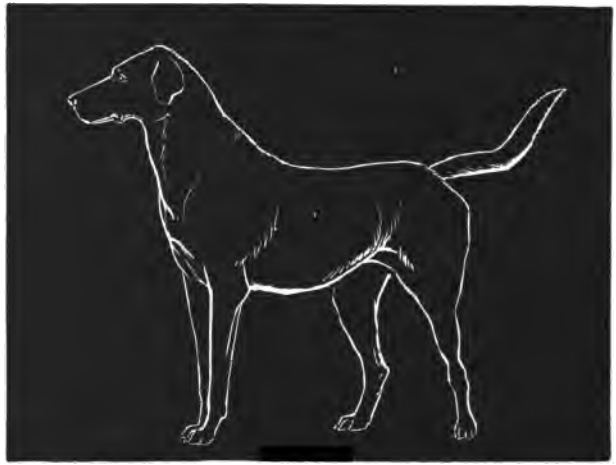
(*a*) *Refer* to these *again, to distinguish* the **toy spaniel,** like the King Charles variety, from the true **hardy sporting spaniel.**

(*b*) *Question* on the similarity of the **great hairy paws** with the **web feet** of swimming birds.

(*c*) *Connect* name with **place of origin.** *Call forth* admiration for the swimming powers and intelligence of this animal so often used in **saving life from drowning.**



A Retriever.



A Foxhound.

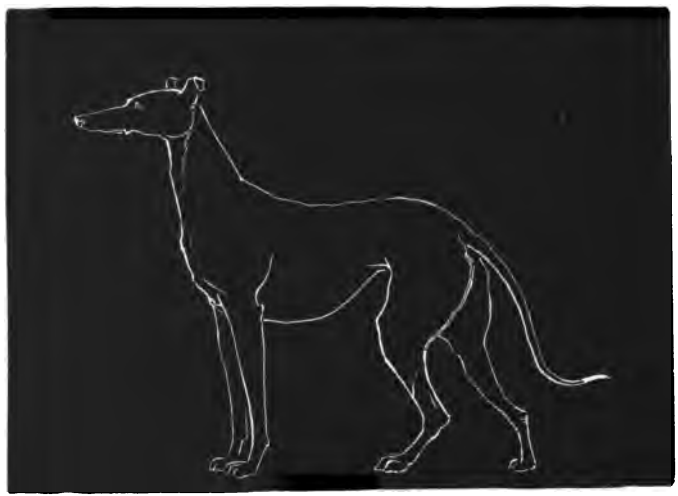
BREEDS OF DOGS—*Continued*

Objects and Apparatus.—Any Two Dogs of Different Breeds (Pups, in a basket); Pictures of Various Breeds (to same scale).

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(4) The **terriers** form a large class of dogs, but of **pure breeds** there are only two kinds—	(4) *Explain* **terrier** to mean "**an earth dog**" (L. *terra* = the earth), or one that not only runs the game to earth, but tries to **follow it into its burrows.**
(*a*) **English** terriers.	(*a*) *Describe* **black and tan** colour, smooth hair, erect ears, and sharp muzzle.
(*b*) **Scotch** terriers.	(*b*) *Describe* **rough white hair,** short muzzle, and short limbs. *Characterise* **all terriers** as sharp and active, generally small, and **quick at killing vermin.**
(5) **Shepherds' dogs** are of two kinds—	(5) *Contrast* original nature of the wild dog, a wolfish **devourer of sheep,** with the present **protector of sheep.**
(*a*) Scotch **collie.**	(*a*) *Draw attention* to its **outward resemblance** to the shape and form of a **wolf.**
(*b*) **Bob-tailed** sheep-dog.	(*b*) *Describe briefly* how these dogs pick out their own sheep, track lost ones, and **understand** the shepherd's words of command for **driving and herding sheep.**
(6) **Other large well-known dogs** are—	(6) *Point out* and *describe briefly*, as—
(*a*) The St. Bernard dog.	(*a*) Large, strong, and trained to life-saving in **Alpine snows.**
(*b*) The mastiff.	(*b*) Large, strong, and of dauntless courage; used as a **watch-dog.**
(*c*) The bulldog.	(*c*) Smaller, but more powerful, with broad head, short muzzle, **underhanging jaw,** displaying **fierce teeth.** *Characterise* by **tenacity**—holding on by its powerful shut jaws.
STAGE III.—Recapitulatory and Added Information.	QUESTIONING.
(1) There are **endless varieties** of dogs.	(1) Who has been at a **dog-show?** Then name some *other kinds* of dogs.

	Deal briefly with any new names offered, and *group* the **breeds or classes**, as thus :—
	The **pug** is a pet dog, but from its broad head, short muzzle, to what strong **breed** do you think it is **related?**—(Bulldog.)
	So *group* **Irish** and other **terriers**, and any other kind *named by scholars.*
(2) Dogs of mixed or **no particular breed** are called **mongrels.**	(2) *Refrain*, even by tone of voice, from *disparaging* mongrels, which are **often clever dogs.** *Instance* the **lurcher** of the **poacher**, a cross-bred **cur** which is **clever** at "lurking" or **stealthy hunting** for its dishonest master.

Recapitulate for Chief Points in the Lesson. See Lesson I.; also Lesson I. of First Series.



A Greyhound.

III.—CAT FAMILY

Objects and Apparatus.—Pictures of Cat, Lion, Tiger, Leopard, Ounce, Lynx, Jaguar, and Puma (to same scale).

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture of Lion.	BY OBSERVATION AND EXPERIMENT.
(1) The lion is **like** a very **large cat.**	(1) *Select* **a child** about four feet high to give **idea of lion's height.**
(2) It is a **tawny,** or yellowish-brown colour; the **male** has a **mane.**	(2) *Tell* that it is the **male** which is **depicted with mane**; *name* the **female** a lioness.
(3) The **tail** is **tufted.**	(3) If shown on picture, *note* a small hook or **horny claw at extremity.**
(4) The **lioness is less** than the lion; the **cubs** or whelps are **heavy-looking.**	(4) *Use* terms "cubs" and "whelps"; lioness is about **one-fourth less** than lion, and more **like the cat** in the **absence of a mane.**
STAGE II.—The Lion: its Structure and Habits.	BY QUESTIONING, TELLING, AND COMPARISON.
(1) In form, the lion is larger, more powerful, and **nobler looking** than the cat.	(1) *Place picture* of cat *by side* of picture of lion; *obtain* these **differences** by questions. *Contrast* in **colour,** also: cat's fur **varies** in colour, but lion's is **constant.**
(2) From its **dignified** bearing, and its **terrific power** compressed into a comparatively small frame, the lion is called the **king of beasts.**	(2) *Note* **heavy set** of body and limbs, and the **muscular neck** for carrying off heavy prey.
(3) The lion has a **majestic roar.**	(3) *Contrast* thunderous sound of **lion's roar** with weak **mew** of a **cat.**
(4) The lion is found in the **hot parts** of the earth (Asia and Africa).	(4) *Obtain* that the lion is **only** to be seen **in shows** in this country.
(5) It retires to its **den in daytime,** and prowls forth in **search** of **prey at night.**	(5) *Educe* that it has **cat-like eyes** for nocturnal hunting.
(6) It **crouches** down, **stealthily approaches** its prey, and **pounces** exactly as a cat on a mouse.	(6) *Compare* **habits,** and *contrast* **size** of beast and its **prey**—the latter may be as large as a buffalo or bullock.
(7) Putrid flesh it refuses; but the **freshly killed prey of the jackal** is often confiscated.	(7) *Describe* jackal as "**the lion's provider,**" as popularly understood.
(8) The lion is subject to great **thirst,** and often **awaits its victims** near a **pool,** as they go down in the **twilight** to **drink.**	(8) *Describe* the **regularity** of a herd of grass-eaters (deer or buffalo) going for their **evening drink,** and the **lion's instinct in lurking** near the vicinity of water.

STAGE III.—Examination of Picture of Tiger.

(1) The tiger is like a large cat, but its colour is **orange striped with black**, and the **tail**, which **tapers** like a cat's, is **ringed** with **black.** [**supple.**

(2) It is a **magnificent**-looking creature, **active** and

BY OBSERVATION AND EXPERIMENT.

(1) *Point out* all these **features** depicted on wall-chart.
Note that **colour** does **not vary**, as in the cat.

(2) The **pose** of the animal *may be made to disclose* these points.

A Lion.

CAT FAMILY—*Continued*

Objects and Apparatus.—Pictures of Cat, Lion, Tiger, Leopard, Ounce, Lynx, Jaguar, and Puma (to same scale)

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE IV.—The Tiger: its Structure and Habits.	BY QUESTIONING, TELLING, AND COMPARISON.
(1) In structure, the tiger is very cat-like; the **points of similarity** being— (*a*) Round **head**, with short, strong **jaws**. (*b*) Sharp **teeth** for tearing flesh. (*c*) Rough **tongue** for rasping and licking clean the bones of its victims. (*d*) Five **toes** on fore foot and four on hind foot, all **retractile**, and on soft **pads**. (*e*) **Eyes** adjustable for night vision, and **whiskers** used as sensitive feelers.	(1) *Base questions* on **previous knowledge of the cat** to bring out these common characteristics of the cat family, as a class the **most** powerful and **ferocious** of all the beasts of prey.
(2) The tiger lives in the **hot parts** of Asia, generally making its **lair** in a **jungle** near a **dense wood** and a watercourse.	(2) *Draw attention* to **protective colouring** of black and yellow stripes, which **correspond** with tall **yellow jungle grass**, and the dark **shadows** in between; **enabling** the stealthy tiger **to remain unperceived** by the approaching prey.
(3) In India tigers become **confirmed man-eaters**, when once they have tasted human blood.	(3) *Relate* some familiar anecdote on the **terrorising influence** gained by tigers over some native village.
(4) They are **hunted** by men mounted in howdahs on elephants' backs, or are **trapped** by the natives in bamboo-covered pitfalls.	(4) *Briefly describe* a **tiger hunt**, as practised by the **British** in India.
STAGE V.—Examination of Picture of Leopard.	BY OBSERVATION AND EXPERIMENT.
(1) The leopard is a **cat-like** animal about **half the height** of the **lion.**	(1) *Indicate* about **two feet** from floor level as height of leopard.
(2) The colour is **dark yellow,** paler on the sides and **fading away** to pure white underneath; the yellow part is covered with **rings and spots of black,** in places arranged like **rosettes.**	(2) *Contrast* with **lion all tawny,** and with **tiger,** whose **tawny** sides are covered with **vertical stripes.** *Note* that there is a **black variety** (Java), and that the **jaguar** of America resembles the leopard, but is larger and more powerful.

STAGE VI.—The Leopard; its Structure and Habits.

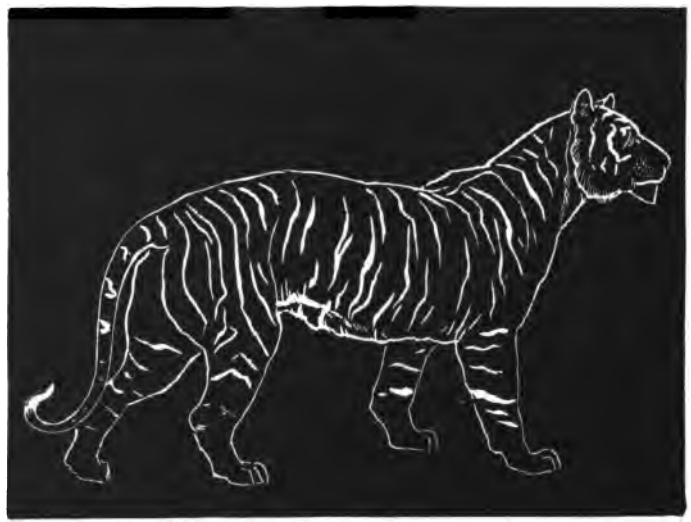
(1) The leopard is found in **hot regions** (Africa, India, and Indian islands), and is an elegant creature, with more **graceful antics** than a cat.

(2) Leopards **live on trees**, where they sport along the branches with great **rapidity of movement, or stretch** themselves along a branch so as to be **scarcely distinguishable from the bark.**

BY QUESTIONING, TELLING, AND COMPARISON.

(1) *Mention* no **geographical localities** beyond the range of the class's knowledge; *suffice* it to describe these hot regions as **distant lands** where exist **large forests** undisturbed by man, and with **ample supplies** of prey.

(2) *Adduce* native name "**tree-tiger**" as evidence of its mode of life.
Distinguish leopard by its **tree-climbing propensities.**
Note that the leopard and the **panther** are considered as the **same animal.**



A Tiger.

CAT FAMILY—*Continued*

Objects and Apparatus.—Pictures of Cat, Lion, Tiger, Leopard, Ounce, Lynx, Jaguar, and Puma (to same scale).

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE VII.—Conclusion and Recapitulation.	By Questioning, Telling, and Comparison.
(1) The **cat tribe** includes several **other animals,** as the **ounce,** the **lynx,** and the **puma.**	(1) *Barely name,* and in passing *distinguish* thus:— **Ounce, greyer** and **rougher** coat than **leopard.** **Lynx,** has peculiar black **ear tips.** **Puma,** the so-called "**lion of America.**" *Question for classification;* Have they a **skeleton?** How many **feet** have they? and so on.
(2) All of them are back-boned (vertebrate), **higher animals.**	(2) *Distinguish* from **back-boneless** (as oyster, lobster, worm).
,, four-footed (quadrupeds).	,, **bipeds** (as men, birds), also from insects and spiders.
,, toe-walkers (digitigrade).	,, **sole-walkers** (as men, bears, badgers).
,, flesh-eaters (carnivorous).	,, **grass-eaters** (as cows, horses).
,, mammals (sucklers).	,, creatures **produced from eggs** (as birds, fishes, and reptiles).
(3) The **cat tribe** all **agree** in certain **points of structure.**	(3) *Question* on these points, as they are set forth in Step (1) of Stage IV.
(4) They **differ** in **size, form, colour,** and **habit.**	(4) *Question* which is **largest?** Which **has stripes?** Which is a **tree-climber?** and so on. *Tell* that if a **skeleton of each** could be shown they would (except in size) be found very **much alike,** especially in the **jaws, teeth,** and **limbs,** those features whose variation aid so much in classification of animals.

Recapitulate for Chief Points in the Lesson. See Lesson I.; also Lesson I. of First Series.

IV.—DOG TRIBE

Objects and Apparatus.—Pictures of Dog, Wolf, Fox, Jackal (to same scale); Specimen of Furs

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture of Wolf.	By Observation and Experiment.
(1) The wolf is a **wild animal** something **like a dog.**	(1) *Compare* with **collie dog's** sharp **nose** and bushy **tail.**
(2) The **muzzle** is long, and the **jaws** are powerful.	(2) *Note* **power** to give a severe **snapping bite.**
(3) The **ears** are pointed and upright.	(3) *Contrast* with droop of dogs' **ears.** *Observe* the **prick-eared alertness** of wolf.
STAGE II.—The Wolf: Structure and Habits.	By Questioning, Telling, and Comparison.
(1) **Wolves** are found in **many parts** of the world, both **warm and cold,** but **none** are left in **England.**	(1) *Tell* that wolves were once found in England, and a **tax of wolves' heads** is mentioned in history.
(2) They **hunt** together **in packs,** few animals being able to stand against them.	(2) *By questions elicit* the **terror inspired** by a foe in **vast numbers.** *Compare* with **packs of hounds.**
(3) They hunt **by scent,** chasing the prey for hours at a **swinging gallop.**	(3) *Compare* with the **running powers of dogs,** particularly hounds and carriage dogs.
(4) Coming up with the **prey,** they spring upon it with **sharp snapping bites**—not tearing it to pieces by sheer strength.	(4) *Contrast* the **lion** and **tiger,** heavy and **muscular** enough to drag the prey down; with **wolf lighter in body,** having to snap, making **teeth meet each bite,** till the victim **bleeds to death.**
(5) Their nature is **fierce** and savage, and yet so **cowardly** that they will not attack a man unless they are in overwhelming numbers, or desperate through **hunger.**	(5) *Elicit* that **beasts of prey** living in **large packs** must devour an enormous **number of victims**; *and infer* that **famine** and **hunger** must occasionally prevail. *Tell* that they often **fight** among themselves, and always pounce upon and **devour a disabled comrade.**
STAGE III.—Examination of Picture of Fox.	By Observation and Experiment.
(1) The fox is **smaller** than the wolf, has a **more bushy tail,** and is **lighter in colour.**	(1) Pictures side by side *disclose* these **differences.**
(2) The fox has thick **fur, sandy red** in colour; **feet** and **ear-tips black**; **shoulders** and **hindquarters** of an **ashen** tinge; cheeks, throat, and tail-tip, **white.**	(2) *Point out* these **colour-markings** on wall-picture.

DOG TRIBE—*Continued*

Objects and Apparatus.—Pictures of Dog, Wolf, Fox, Jackal (to same scale); Specimen of Furs.

MATTER SUMMARISED.

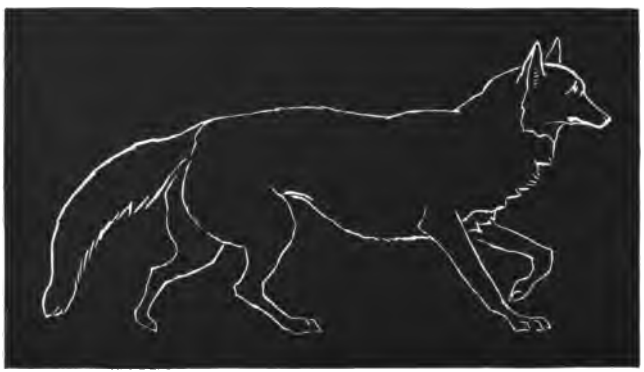
STAGE IV.—The Fox: Structure and Habits.

(1) **Compared with dog,** the fox has—
- (*a*) More pointed **muzzle.**
- (*b*) **Tail** longer and more bushy.
- (*c*) **Ears** triangular instead of rounded.
- (*d*) **Eye** more like that of cat, adjusting itself to the amount of light.

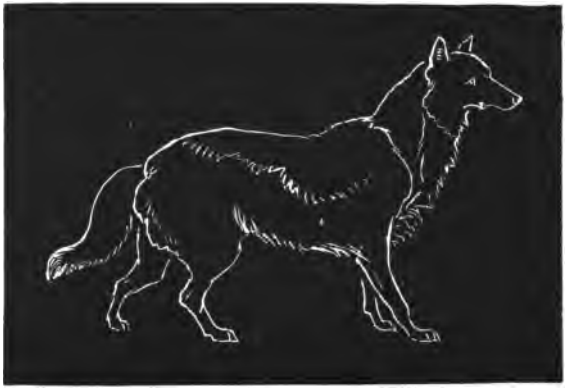
DETAILED HINTS AND SUGGESTIONS.

By Questioning, Telling, and Comparison.

(1) *Make these points* of **contrast** from pictures.
- (*a*) *Note* sharp look of a **pointed** muzzle.
- (*b*) *Name* the tail "**a brush.**"
- (*c*) *Note* how **dogs' ears** are nearly always **pendent** in some degree.
- (*d*) *Educe* that the **adjustable pupil** denotes **nocturnal** habits.



A Fox.



A Wolf.

(2) The fox is the **largest beast of prey** found wild in **this country.**
(3) It passes the **daytime** in a **burrow** which it digs.
(4) **At night** he is often a marauder of the **poultry-yard**; when compelled he will eat eggs, mice, frogs, and snails.
(5) The fox is exceedingly **crafty**, and prefers to **waylay his victim** rather than chase it.
(6) In the **winter** the fox **is hunted** by men, horses, and dogs.

(2) *Tell* or obtain this fact; also that it is **not** large enough to **attack a person.**
(3) *Describe* this **underground den** as divided into living, sleeping, and storing apartments, and having **two openings** to permit of escape.
(4) *Quote* **stories** of "Fox and Goose."
Suggest **depredations** among feathered game, as well as tame poultry.
(5) *Instance* his **waiting** outside a **rabbit-hole.**
(6) *Describe briefly* a **fox-hunt.**

A Jackal.

STAGE V.—Examination of Picture of Jackal.

(1) The jackal is **smaller** than the wolf, but **much like** it.
(2) The **eyes** are **small**, and its **coat** is of a **dirty** greyish yellow.

BY OBSERVATION AND EXPERIMENT.

(1) Pictures side by side will *disclose* **likeness** and **unlikeness.**
(2) *Note* **unprepossessing** appearance, though so much like a dog.

DOG TRIBE—*Continued*

Objects and Apparatus.—Pictures of Dog, Wolf, Fox, Jackal (to same scale); Specimen of Furs.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE VI.—The Jackal: Structure and Habits.	BY QUESTIONING, TELLING, AND COMPARISON.
(1) Jackals are found in **warmer regions.**	(1) *Ask* where **lions are found,** and *infer* that the "lion's provider" must **also live** in warm regions.
(2) Like wild dogs and wolves, they **band together,** and chase the **selected prey**—then strength, speed, and courage **cannot avail the quarry.**	(2) *Ask* how wolves and **hounds hunt**—jackals also combine in **packs.** *Name* the wild boar, and even the **tiger, as victims** to the wild dog of India. *Describe* **manner of attack**—as soon as the victim is brought to bay he has **not a moment's respite,** his innumerable foes keeping up a ceaseless **onslaught** from **all sides at once.**
(3) The **voice** of the jackal is a **more terrific** howl than that of tiger, and it is this cry which probably **rouses the prey for the lion.**	(3) *Connect* the term "**lion's provider**" with the rousing of the forest and setting in motion of the more timid animals. *Picture* a **lion** making a **meal of an ox,** while **a ring of jackals wait** patiently for the **remnants** of the feast.
(4) The jackal unites the **cowardice** of the wolf with the **impudence** of the dog.	(4) *Tell* that jackals prefer to **prey on smaller animals,** overpowered without difficulty. *Sum up* the **character of the jackal** as one uniting all the bad qualities of the dog tribe.
STAGE VII.—Conclusion and Recapitulation.	BY QUESTIONING, TELLING, AND COMPARISON.
(1) The wolf, fox, and jackal are **alike in many respects.**	(1) *Gather up* the **common qualities** of form and habit by *recapitulatory questioning.*
(2) They **differ in smaller details.**	(2) *Gather up* the **minor divergences** of form and habit by *recapitulatory questioning.*
(3) There are **characteristic differences** between the **dog tribe** and the **cat tribe.**	(3) *Detail* these **differences**— (*a*) Cat tribe are formed to **approach** prey **by stealth,** whereas dog tribe **run it down** by superior speed. (*b*) Cat tribe are formed with great **muscular strength,** whereas dog tribe have **slight, wiry, powerful limbs.**

(c) Cat tribe are formed to **drag prey down** by strength of neck and shoulders; dog tribe **combine in packs.**

(d) Cat tribe have **strong sharp claws**; the dog tribe have **nails blunted by the chase.**

(e) Cat tribe prefer prey **captured by themselves**; the dog tribe will eat **offal** and putrid flesh, and more readily take to **vegetables** (as grasses).

Recapitulate for Chief Points in the Lesson. See Lesson I.; also Lesson I. First Series.

V.—THE CUD-CHEWERS

Objects and Apparatus.—Pictures of Cattle, Sheep, Goats, Antelopes, Deer, Camel, Giraffe (all to same scale); detailed Drawings of Teeth and Stomachs of Ruminants; prepared Jaw-bones, Hoofs, Horns.

MATTER SUMMARISED.

STAGE I.—Examination of Pictured Animals.

(1) There is a **general resemblance** in all these animals; they are all gentle-looking grass-eaters.

(2) All have **cloven hoofs**, which are really two middle toes of full length; behind there are two little toes, or "spurs."

Resemblances of internal structure:—

(3) All are **without teeth in upper jaw,** which is provided with a hard **pad** instead.

The **tongue** is long, hard, and rough for cropping herbage.

(4) All have the **stomach** divided into four **parts.**

(5) All are **covered with hair,** short or long, or crinkled into wool; and in **other** ways have **similarities** of form.

DETAILED HINTS AND SUGGESTIONS.

By Observation and Telling.

(1) *Place* all these wall-pictures *side by side* in the **order named above.**

Note an **aspect of timidity** rather than ferocity, common to all, large as well as small.

(2) *Point out* this **similarity** on pictures. *Exhibit* some **hoofs.**

Note **exceptional** development of **camel's foot**—hoofs very small, while frog is a large soft pad.

Tell resemblance (3) *and* (4), *which cannot be observed from pictures.*

(3) *This can only be shown by detailed drawings;* the prepared jaws of a sheep will also be found useful.

Picture of **giraffe's tongue,** in act of **grasping** a bunch of leaves, will be useful.

(4) This can *only be made apparent by a detailed drawing.* (As in Lesson on "Cow.")

(5) *Having told* these **resemblances** of **internal structure,** *invite* further points of **resemblance, outward** and easily **apparent,** as—all are hair covered, vertebrates, quadrupeds, and mammals.

Objects and Apparatus.—Pictures of Cattle, Sheep, Goats, Antelopes, Deer, Camel, Giraffe (all to same scale); detailed Drawings of Teeth and Stomachs of Ruminants; prepared Jaw-bones, Hoofs, Horns.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(6) Points of **dissimilarity** may be found; as in— (*a*) **Sizes** and **shapes** of **body**, and length of **limbs.** (*b*) **Colour** and **texture** of coverings, and shapes of **tails.** (*c*) **Horns absent,** or varying in **shape** and **substance.**	(6) *Encouragingly invite* the pointing out of **unlikenesses**, the **features** to be **contrasted being**— (*a*) Suggested under these four points printed in heavy type. (*b*) ,, ,, three ,, ,, ,, (*c*) ,, ,, three ,, ,, ,,
STAGE II.—Detailed Examination of Horns.	By Observation and Telling.
(1) **Most** of these animals **have horns,** except the **camel,** which is **entirely without,** and the **giraffe,** which has **a lump** sticking out each side the head, and another in the middle of forehead.	(1) *Point out* these **exceptions first.**
(2) The horns of **oxen, sheep, and goats** are— (*a*) Of same **material** as hoofs. (*b*) **Hollow.** (*c*) **Larger in males** than in females. (Many of the **females,** as in sheep, are **hornless.**)	(2) *Group* these for **comparison.** (*a*) *Pass round* a **horn** and a **hoof together.** (*b*) *Exhibit* a horn made into a **bugle.** (*c*) *Discover* that horns are weapons of **defence,** and that **males are bolder** in attack.
(3) The horns of **deer** are confined to the **males,** with single **exception of reindeer.** (*a*) They are not real horns, but **branching antlers.** (*b*) They are of same **material as bones.**	(3) *Group* these for **comparison.** (*a*) *Pass round* an **antler.** (*b*) *Pass round* a **large bone** for comparison.
(4) **Antelopes** are very like deer, but **differ in their horns,** which are more like those of goats.	(4) *Place* picture of **antelope** between those of deer and goats, as a kind of **connecting link.** *Tell*—(*a*) Horns of oxen, sheep, goats, and antelope are **permanent.** (A chamois horn would be useful.) (*b*) Horns of deer are **shed each year.** (See Lesson on Deer.)

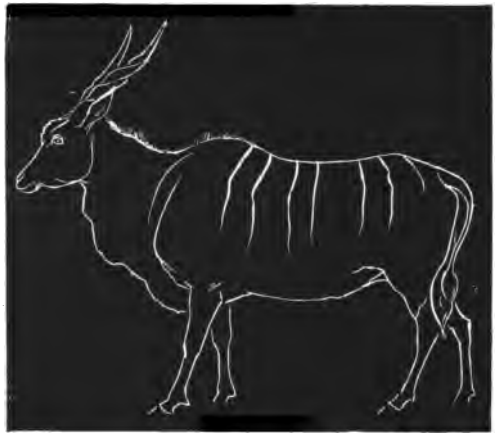
STAGE III.—Cud-chewers or Ruminants.

(1) **All** these animals **are cud-chewers,** and have certain **characteristics in common,** viz.-

(*a*) Cloven **hoofs.**

(*b*) No **teeth** in upper jaw.

(*c*) A **stomach** in four divisions.



An Antelope.

(2) A **cud-chewer** (or ruminant) **sweeps the herbage** into the mouth **by means of a long tongue.**

(3) The food is then **quickly swallowed** into a bag called the **paunch,** or first division of the stomach.

BY QUESTIONING, TELLING, AND COMPARISON.

(1) *Tell* that **all** the animals **are cud-chewers.** *Review by questioning* on these **characteristics.**

(*a*) *Contrast* with **solid hoof** of horse. *Note* that the **pig** has cloven feet, but is not ruminant. [**ruminants.**

(*b*) *Contrast* with **teeth of horse** and ass—**herb eaters** but **not**

(*c*) *Contrast* with **our stomachs,** in one bag.

A Goat.

(2) *Memory will recall* how a **horse** collects loose food with its delicate **lips,** and a **cow** with her **long rough tongue curled round each grass tuft**; then how both **grip** the grass, and by an **upward jerk** tear it off.

(3) *Recall how* the **horse** makes a **clean bite,** having **two rows of cutting teeth**—grinds, and swallows **slowly.** *Recall how* the **cow swallows quickly without** any **grinding** or chewing.

THE CUD-CHEWERS—*Continued*

Objects and Apparatus.—Pictures of Cattle, Sheep, Goats, Antelopes, Deer, Camel, Giraffe (all to same scale); detailed Drawings of Teeth and Stomachs of Ruminants; prepared Jaw-bones, Hoofs, Horns.

MATTER SUMMARISED.

(4) When the cud-chewer has **collected a sufficient supply,** it lies down to "**chew the cud,**" a small lump of the food **brought back from** the second division of the stomach, called the **honeycomb,** where it has been formed into **little balls for this purpose.**

(5) The food is **then properly masticated,** mixed with **saliva** (spittle), and passed back **through the maniplies** (or third stomach) into the fourth or **true stomach,** where it is properly **digested.**

(6) **Most** of the ruminants have **horns.**

DETAILED HINTS AND SUGGESTIONS.

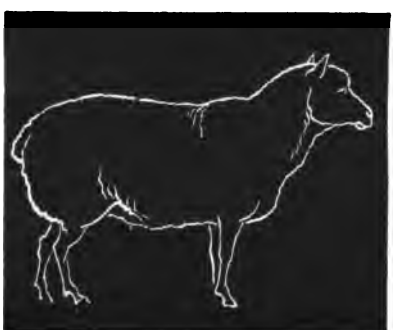
(4) *Recall* this action of the **cow,** who gives a sort of a **hiccup** and brings up **a lump of food** and **slowly chews** and grinds it properly with **back teeth,** the **jaws moving sideways.**

Describe a "**cud**" as a ball of green food. *Recall* the **appearance** of honeycomb cooked as **tripe.** [only **one stomach.**

Teach the **necessity for** our **masticating** food properly, as we have

(5) *Tell* that the food is now in a **semi-fluid** condition, to pass **through the maniplies** or "many folds" **into** the red, or **reed,** as the fourth stomach is called.

(6) *Question* thoroughly for *review* and re-arrangement of matter.



A Sheep.

A Cow.

STAGE IV.—The Camel and the Giraffe—leading features.

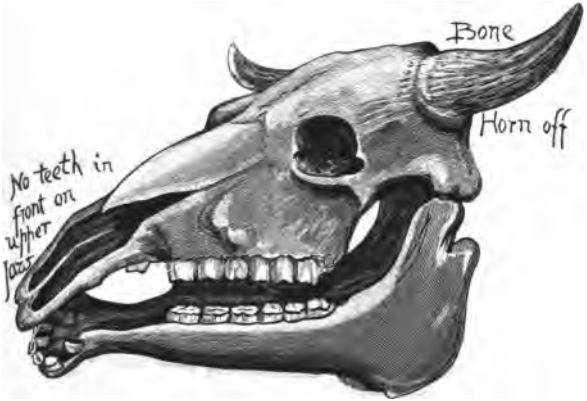
(1) The **camel** is **exceptional** in that—

(*a*) The **maniplies** are **wanting**, while the **cells** of the **honeycomb** are enlarged and made receptacles for **storing water**.

BY QUESTIONING, TELLING, AND COMPARISON.

(1) *Impart* to junior classes *only* so many of following *details* as are generally necessary *to justify* the camel's title, "**the ship of the desert.**"

(*a*) *Note*, water is **also** stored in **the paunch.**



Head of an Ox.

Horns: (1) Sheep; (2) Ox; (3) Deer.

THE CUD-CHEWERS—*Continued*

Objects and Apparatus.—Pictures of Cattle, Sheep, Goats, Antelopes, Deer, Camel, Giraffe (all to same scale); detailed Drawings of Teeth and Stomachs of Ruminants; prepared Jaw-bones, Hoofs, Horns.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(*b*) **Pads** take the place of **hoofs.**	(*b*) *Explain* action as of a **cushion** on the **soft sand** of the desert.
(*c*) **Callous pads** of hard skin on the **leg joints and chest.**	(*c*) *Explain* use—to **kneel upon** on hot sand or hard rocks.
(*a*) **Nostrils** that close.	(*d*) *Explain* use—to **keep out sand** in a sandstorm.
(*e*) **Teeth** in the upper jaw.	(*e*) *Note* this **feature** as the **most exceptional** one.
(2) The **giraffe** is **characterised by**—	(2) *Run over* these characteristics briefly *on the picture.*
(*a*) Great **height.**	(*a*) *Designate* the "**tallest animal in the world**" (nearly twenty feet).
(*b*) Peculiar **build for reaching its food**—the tender shoots at the top of trees.	(*b*) *Infer* that its **food** must be **high up.**
(*c*) The **fore legs are not really longer** than hind pair, but appear so from the **size of the shoulder blades.**	(*c*) *Note* continuous **slope of back** from neck to tail. *Describe* the awkward **straddle** of legs when the head tries to **reach down to ground.**
(*d*) The **tongue** can be **lengthened at will,** and made thin enough to enter the barrel of a latch-key.	(*d*) *Question* on the **uses** to which these ruminants put their **tongues.** *Tell* that giraffe can **select one leaf** out of a bunch **with its tongue.**

A Camel's Foot.

Recapitulate for Chief Points in the Lesson. See Lesson I.; also Lesson I. in First Series.

VI.—USEFULNESS OF THE HORSE

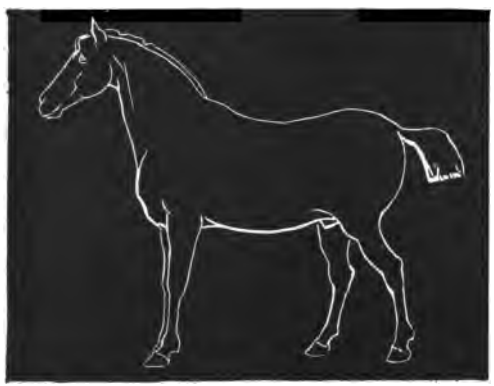
Objects and Apparatus.—Pictures of the Horse harnessed for every kind of work.

MATTER SUMMARISED.

STAGE I.—Examination of Pictures of Horses at Work.

(1) Horses are **harnessed** to do **all kinds of work** for man.

(2) The **harness** is made **to suit the kind of work** to be done.



Outline of a Horse.

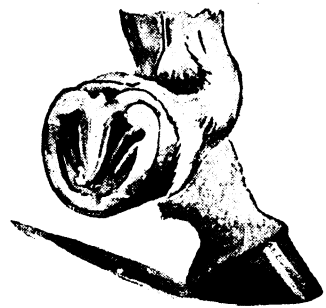
DETAILED HINTS AND SUGGESTIONS.

By Observation and Memory.

(1) *Exhibit* pictures and *ask*—**Why** are all these horses **harnessed?** (To work.) [as per pictures.)
Name some **different kinds of work** they are doing?—(Answers
Now **what other kinds** of work **do you know** which horses do?—(Draw upon memories.)

(2) What is the **saddle for?**—(To seat the **rider.**)
What is the **collar for?**—(A pad or **cushion** to take the **strain of draught work.**)
Point out the **hames** to which the **traces** are attached.
What are **blinkers for?**—(To **prevent** draught horses **being distracted** by seeing any way except forward.) *Note* that hackney or **riding bridles** have no blinkers.
State that **blinkers** are quite **unnecessary** if horses have been broken in without them.

A Horse's Hoof (Shod).



A Horse's Hoof (Unshod).

Insist that all **harness** should **fit comfortably** if the horse is to move freely and do its work easily.

USEFULNESS OF THE HORSE—*Continued*

Objects and Apparatus.—Pictures of the Horse harnessed for every kind of work.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE II.—The Horse's Suitability for Work.	BY QUESTIONING, TELLING, AND COMPARISON.
(1) The horse possesses **greater speed and strength than man.**	(1) What were **men** before they were civilised and clever enough to do so many things?—(**Savages.**) *Proceed to argue* that savage man **had to hunt** for ——?—(**Food.**) That he soon discovered he was **not so swift** as many of **the animals** he ——?—(**Hunted.**)
(2) Yet at the same time is **docile and easily trained.**	(2) That **savage man found** among the other wild animals **one** which had great **speed and endurance,** and yet was easily **tamed and controlled**—this was the ——?—(**Horse.**)
(3) The **teeth formation** with the "bar" or empty space between the front and back teeth **decided the fate of the horse**—he became the servant of man.	(3) *Refer* to the **"bar."** (See Lesson on Horse.) *Connect* the "bar" with the **bitting,** the **ready controlling,** and guiding of the horse. *State* that no one knows when the horse was **first domesticated,** it was so easily accomplished.
(4) The **structure** of the horse is **well adapted** to make it a beast of **burden** and of **draught:** as its—	(4) *Distinguish* between **"bearing"** and **"dragging"** loads.
(*a*) Breathing through the **nostrils,** and from a broad **chest.**	(*a*) *Experiment* by setting a **child to run**—then *question* on breathing.
(*b*) Solidity of **hoof** permits of fast, or slow and heavy work.	(*b*) *Infer* the **necessity** of a firm and **sure tread,** especially when **heavily laden.**
(*c*) **Natural paces** of walking, trotting, and galloping **suit all tasks.**	(*c*) *Ask* for suitable **tasks to each pace.**
(*d*) Long thin **legs** are **for speed,** and its short muscular **thighs for strength.**	(*a*) *Compare* its **legs** with those of **deer** and of **elephant**—coming between the two.
(*e*) **Curved back** seems fitted for man **to ride upon.**	(*e*) *Claim* this sinking of the back as a natural and secure seat.
(5) **No inventions** to supersede the horse have **succeeded in making it less useful.**	(5) *Note that* the locomotive and all steam **engines** have their work estimated in **"horse power."** *Note that* bicycles, any more than railways, have **failed to lower the price of horses,** which are used as much as ever.

STAGE III. — The Kinds of Work which Horses do.

(1) The horse is **saddled** for men to ride upon in—
- (*a*) The **chase.**
- (*b*) **War.**
- (*c*) **Travelling.**

(2) The horse is used in **draught** of all sorts, as in—
- (*a*) Wheeled **vehicles** for **business.**
- (*b*) Wheeled **vehicles** for **pleasure.**
- (*c*) Vehicles **without wheels.**
- (*d*) **Canal** boat work.
- (*e*) **Farm** work.
- (*f*) **Mining** work.
- (*g*) **Grinding** work.

(3) The horse has earned the title of "**man's best servant.**"

BY QUESTIONING, TELLING, AND COMPARISON.

(1) *Opine* that men rode **bare-backed** at **first.**
- (*a*) How does **hunting** need speed and **endurance** ?—(Wild animals are often swift and strong.)
  Question on **fox-hunting** and **stag-hunting.**
- (*b*) What is another name for **horse-soldiers** ?—(Cavalry.)
  Why do **soldiers need to be mounted** ?—(To reach place of **attack** quickly—to **overpower** foot soldiers—to **overtake** flying foes.)
- (*c*) *Obtain* that a **mounted traveller** can go **farther and faster** than a pedestrian ; that horse travelling is **practicable** where **no roads** exist.

(2) *Say* that the horse's draught work may be **traced from land to water.**
- (*a*) *Let class enumerate*, as carts, wagons, vans, **business traps, professional broughams**, cabs, omnibuses, and tramcars.
- (*b*) As in **pleasure brakes.**
- (*c*) As in **sledges**, in cold countries like Russia and Canada.
- (*d*) *Discover* that by the **aid of water** the load may be increased **twenty-fold.**
- (*e*) *Discover* that this includes more than cart and wagon work—**ploughs and harrows.**
- (*f*) *Describe* the work of **pit ponies** in a coal-mine.
- (*g*) *Describe* an old-fashioned **gin**, round which a horse worked **to turn a mill.**

(3) *Accept* any other tasks of the horse, which the scholars may give.
Then *inculcate* the duty of **kind treatment** for **so valuable** a servant.

Recapitulate, drawing largely upon the children's memories familiar with the work of the horse.
See Lesson III. of First Series.

VII.—HORSE AND ASS COMPARED

Objects and Apparatus.—Pictures of Horse and Ass (or Models); Specimens of Horse's Teeth.

MATTER SUMMARISED.

STAGE I.—Examination of Pictured Horse and Ass.

(1) In **form** the animals are **alike** in—

(*a*) Both being **large quadrupeds**, with **slender legs** and **solid hoofs**.

(*b*) Having **long heads**, with **prominent eyes** and **large nostrils**.

(*c*) Having **cutting teeth** in front, **grinding teeth** at the back, and an **empty space** between them.

(*d*) Having **bodies** which are **large**, yet well **rounded** and **graceful**, with **broad chests** and slightly **curved backs**.

(2) In **form** the animals are **unlike** in—

(*a*) The **horse is larger** than the ass.

(*b*) The **head of the ass** is rather **heavier** looking, and, though carried on a long neck, the **neck is not so arched**.

(*c*) The **ears** of the ass are **long**.

(*d*) The **mane** of the horse is **long and flowing**, while that of the ass is **short and upright**.

DETAILED HINTS AND SUGGESTIONS.

By Observation.

(1) *Set out to discover* likenesses in the **outward forms**.

(*a*) *Interchange* the **terms** "four-footed" and "quadruped." *Draw attention* to **comparative slenderness** of legs, and **solidity** of hoofs. *Contrast* hoofs with cloven hoofs (cow) and with nails (dog, man).

(*b*) *Admire* **shapeliness of heads** on animals so large, the **boldness of the eyes**, and the clear, wide, **roomy** breathing spaces of the **nostrils**.

(*c*) *Show* specimen teeth. An enlarged *diagram*, or a *B.B. sketch* will be really necessary to show the gap or "**bar**" between the tusks and the grinders. *Show pictures* of both animals, "**bitted**."

(*d*) *Point* to these **graceful curves** and outlines. *Contrast* with **ungainly** appearance of the **elephant**.

(2) *Deal first* with the features already touched upon, and in same order as in previous step.

(*a*) *Show* by the drawings, if to same scale; otherwise, *discover* from memory.

(*b*) *Admire* the arched neck and **nobly carried head** of the horse; *note* the straight neck and **humbler carriage** of the ass's head.

(*c*) *Call attention* to prettiness of horse when **ears are "pricked" forward**, which those of the ass seldom are.

(*d*) *Memory will recall* how the longer **mane dances** up and down as the horse goes along, and how some horses have their manes cropped short ("**hogged**"), and some **plaited**.

(*e*) The **tail** of the horse is a **bush of coarse hair**; the tail of the ass has only a **tuft at the end.**

(*f*) The **covering** of the horse is short **glossy hair**; that of the ass is thicker, **coarser, and duller.**

(*g*) The **colour** of the horse **varies** more, and is often **brighter than** that of **the ass.**

(*e*) *Memory will recall* that the **tails** of horses are also **cut and trimmed.**
Show how **long** hair starts from **base of horse's tail,** but only at **tip of donkey's.**

(*f*) *Show* **sleekness** of coat depicted on picture of horse.
Memory will recall how thick, dull, and **ruffled** is the coat of the ass.

(*g*) *Name* the **colours** shown on the pictures.

STAGE II.—Discovering of Likeness and Unlikeness in Habit.

(1) **Likeness** in habit or character.

(*a*) Both animals are **herbivorous,** but not ruminants.

(*b*) Both animals are easily trained and **brought under control** by means of the **bit.**

(*c*) Both **breathe** through the **nostrils.**

(*d*) Both are **strongly made** in body and limb for **beasts of burden.**

(*e*) Their slightly **curved backs** seem **fitted** for man **to ride upon.**

BY QUESTIONING, TELLING, AND COMPARISON.

(1) (*a*) If both animals are turned into a **field,** on what will they use their front **cutting** or biting **teeth**?—(**Grass.**) If fed in a **stable,** what **dried and hard** vegetable food will need the **use of their grinding teeth**?—(Beans, oats, chaff.)

(*b*) How are these animals **guided,** when being ridden or driven?—(**By reins.**) To what are the **reins fastened**?—(**Bit.**) Where does the **bit fit**?—(Empty space in the teeth.)
Connect the words "bit" and "bite."

(*c*) *Recall* how freely both animals **breathe** through nostrils **when bitted,** and their **teeth** are **clenched.**
Recommend this for **imitation of children**—air gets warmed before entering the lungs, thus preventing coughs and colds.

(*d*) *Direct attention* to **bulk of** bone and muscle, **indicating strength**; and to **breadth** of **chest** for perfect **breathing and endurance.** *Contrast* slender **legs for speed** with shorter and heavier ones of slow-moving ox.
Which is the harder, **a dog's foot** or a horse's?—(Horse's.) Which is better **suited for a beast of burden,** the solid hoof of the horse and the ass, or the padded toes of dog?

(*e*) Is a straight back, or a **slightly curved back,** the **more convenient seat** for a rider?
Demonstrate that both in **build and size** these animals are **fitted for work.**

HORSE AND ASS COMPARED—*Continued*

Objects and Apparatus.—Pictures of Horse and Ass (or Models); Specimens of Horse's Teeth.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(*f*) Both animals are docile, willing, and **obedient**, and **display intelligence.**	(*f*) *Instance* the fact of these strong creatures being driven and **controlled by women and children**; and that **wild horses are tamed** in a few hours and made to work. *Ask* for **anecdotes of their intelligence.** *Remind* of their **good memory** for places of call, or frequented routes; as in a milkman's horse.
(*g*) They are **seldom vicious**, and always fight by **kicking.**	(*g*) *Attribute* vice to ill-treatment, and the **result of fear**—a sign of **bad breaking in.** *Tell* of **strength and precision** of a **kick**—their means of defence when flight fails.
(2) **Differences** of habit and character.	
(*a*) The ass is even a more **hardy animal** than the horse:	(2) (*a*) *Opine* that cruelty and neglect have **spoiled the despised donkey.** *Contrast* our domestic donkey with the **spirited asses of the East.**
(*b*) Wears a **rougher coat** and needs **less shelter:**	(*b*) *Connect* cause and effect—**bad grooming and exposure** leading to cheapness and general neglect of the ass.
(*c*) And is **less dainty** in its feeding.	(*c*) *Gather* that donkeys eat **thistles**, and can be fed on any green waste land or hedgerow. *Tell* that what they really prefer to grass are **herbs** which are **salt, bitter,** and **milky.**
(*d*) **Neglect** and ill-treatment have given the ass a **reputation for stupidity.**	(*d*) *Admit* that the ass is **stubborn** and self-willed, but *argue* that **generations of ill-usage** have spoilt its temper. *Ask*—does a **baby** fly to the arms of a **nurse who habitually chastises** it? And would you call the baby **stupid** because it **refuses to respond?**
(*e*) Although smaller and not so strong, the **ass is surer** and safer than the horse **for mountain paths.**	(*e*) *Remind* of any **hilly place of resort** where donkeys are hired to carry visitors up hills. *Sketch on blackboard* the hoofs of horse and ass, side by side, to show comparative **narrowness and pointed end** of latter; *describe* its hollow middle and **sharp rim** which give a "bite" and a firmer purchase to the **tread.**

STAGE III.—Differences in Use and Treatment.

(1) (*a*) In **use,** we employ the horse for **harder work and faster work;**

(*b*) While only **light work** is reserved for the **donkey.**

A Horse's Head.

(2) (*a*) While the high-spirited and **high priced** horse is always **well cared for;**

(*b*) The humble **donkey** is oftener the **drudge of the poor** than the pet of the wealthy.

(1) (*a*) *Draw on children's knowledge* for the fact that **long journeys** and **heavy loads** fall to the **superior** strength and speed of the **horse.**

(*b*) *Class to enumerate* the **tasks suited** to the donkey, and for which it is generally employed.

Note that in **riding** it is better to sit well over the **fore legs of the horse,** but over the **hind legs of the ass,** where respectively their greater **strength lies.**

Formation of a Horse's Head.

(2) (*a*) *Educe* that what we prize or **value most,** we take **most care of.**

State that however **valuable** a horse may be **alive,** it is almost **worthless dead.**

(*b*) *Call* the donkey "**the poor man's horse,**" and *justify* the title from the children's knowledge.

Recapitulate for Chief Points in the Lesson. See Lesson I.; also Lessons III. and IV. in First Series.

VIII.—USEFULNESS OF THE COW

Objects and Apparatus.—Pictures of Oxen at Work; Dairy Operations; Tanning and Currying Operations; Milk standing in a Shallow Vessel; a clean Phial-bottle with some Cream; Leather, Cow-hair, a Piece of Broken Wall-plaster, Suet, Tallow, Soap, Candle, Hornware, Gelatine.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictures and Objects. (1) Usefulness of the cow **while living.** (*a*) **Gives milk,** from which are made **butter and cheese.**	By Observation and Experiment. (1) (*a*) *Early in Lesson, produce* some **milk** which has been **standing** some hours in a **shallow vessel.** *Skim* the **cream** from the top; *put it* into **phial,** cork it, *give it a child* with instructions **to shake it,** and when tired to pass it round the class **till a bit of butter** is churned.

USEFULNESS OF THE COW—*Continued*

Objects and Apparatus.—Pictures of Oxen at Work; Dairy Operations; Tanning and Currying Operations; Milk standing in a Shallow Vessel; a clean Phial-bottle with some Cream; Leather, Cow-hair, a Piece of Broken Wall-plaster, Suet, Tallow, Soap, Candle, Hornware, Gelatine.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
	Take **another vessel** of new **milk**, *have it tasted* to show its **freshness**; *produce* some **rennet** (or other strong acid) and have its **acidity tasted**; *put some* in the milk to **curdle it**.
	Exhibit the **solid curds** and the watery **whey**.
(*b*) The **ox** is used as a **beast of burden** in some parts of the world.	(*b*) *Show picture* of **oxen yoked** to a load—yoke taking place of collar on a horse.
(*c*) From the **cow** is taken thin matter, called **lymph**, with which **to vaccinate.**	(*c*) *Explain briefly* the **scratching** of the skin, putting the **lymph** in the scratch, the **scab** which follows, and the effects therefrom preventing the more dangerous disease of **small-pox**.
	Bare a few **arms** to *exhibit* **scars** left by **vaccination**.
(2) Usefulness of cow **when killed**—	(2) (*a*) *Exhibit* some **fresh suet** and some **boiled tallow** on same plate for comparison.
(*a*) The **flesh** is eaten as **human food**, and the **waste fat** is the **tallow** of which **soap** and candles are made.	*Exhibit* some **soap** and a **tallow candle** to note fatty composition.
(*b*) The **hide** is tanned into **leather**; and the **hair** is used to make **plaster** hold together.	(*b*) *Pass round* a piece of **raw hide** with the hair on, and a piece of **sole-leather.**
	Exhibit a piece of **broken plaster**, with a fracture **held together** by cow-hair in it.
(*c*) The **horns** are used for making cups, lanterns, &c.	(*c*) *Exhibit* some **hornware.**
(*d*) The **bones** are used for turnery.	(*d*) *Pass round* some **bone buttons**, bone egg-spoons, &c.
(*e*) The **hoofs** and parings of the hide are boiled into glue.	(*e*) *Pass round* some **glue** and some **jelly** or **gelatine**, prepared by boiling scraps, for comparison.
STAGE II.—Dairy Work.	BY QUESTIONING, TELLING, AND COMPARISON.
(1) Milk is—	(1) *By questioning educe* that milk—
(*a*) A **palatable** and **nourishing** food:	(*a*) Is **pleasant** to the **taste** (as per experiment):

(*b*) Needing **no cooking**:

(*c*) Able by itself to **sustain life** in full **health.**

(2) Milk may be **divided into three parts,** viz.—
(*a*) **Cream,** the light fatty portion which rises to the top (milk-fat is 4 per cent. of the whole = a heat-giving food).

(*b*) **Curds**, the solid part, which can be made to coagulate by a little acid (casein is 4 per cent. of the whole = a flesh-forming food).
(*c*) **Whey,** the watery part (water 86 per cent., milk-sugar 5 per cent., and mineral matter 1 per cent. = bone-forming).

(3) Cream is made into **butter** by the process of **churning** or shaking about.

(4) **Cheese** is made by **curdling** the milk with rennet, **pressing** the curds in **moulds,** then salting and **drying.**

(*b*) Is taken **raw** (is better **boiled,** although **a skin forms** on the top, and robs it **of some** of its albuminous substance):
(*c*) And **unaided sustains life** of babes, calves, and other young creatures (adult life, as a rule, needs solid food).
Claim milk as a **model food, exceptional** in sustaining life unaided.
Speak of necessity of **mixed diets** when babes cease to feed on milk; and of the diseased and **weakly frames** of **improperly fed** children, such as suffer with **Rickets.**

(2) (*a*) How do we **know** that **cork** is **lighter** than water?—(**Floats.**) How do we **know** that the **cream** is the **lightest part** of the milk?—(Rises to the top.)
Refer to the experiment of skimming—*designate* the residue "**skim-milk.**"
(*b*) *Inform* that **skim-milk** may be divided into **two parts,** curds and whey; and that the acid always used by **cheese-makers** is **rennet,** a fluid prepared from the stomach of the calf.
(*c*) *Explain* presence of **so much water** as necessary for **conveying** so much **nutriment** in a **liquid form.**
Present **analysis** to senior Standards only; for juniors *it may suffice to state* that milk is a **model food,** compounded **in right proportions** for feeding and building up the frame.

(3) *Try* **results** of the class's **churning.**
Explain that the **cream** is really tiny **balls of fat,** held in **thin skin**; and that the shaking **breaks** the **skins** of these tiny globules, and **allows** the yellow **fat to unite in a mass** we call butter.
Add that butter-makers **wash away** the empty **skins,** and then **salt** to **taste.**

(4) *Ask* what **shape** the **mould** will be.
Describe the **press,** and the process of pressing.

STAGE III.—Leather Manufacture.

(1) To **prepare** the hides or skins, they are—
(*a*) **Soaked** in water for a week or two, **to soften.**
(*b*) Then placed in tanks or **vats of lime-water** for ten days to **remove the hair.**

BY QUESTIONING, TELLING, AND COMPARISON.

(1) These, and all **processes** taught, may be *tabulated on blackboard.*
(*a*) *Children will suggest* **water for softening.**
(*b*) *Ask* what **use** is made of **cow-hair.**

USEFULNESS OF THE COW—*Continued*

Objects and Apparatus.—Pictures of Oxen at Work; Dairy Operations; Tanning and Currying Operations; Milk standing in a Shallow Vessel; a clean Phial-bottle with some Cream; Leather, Cow-hair, a Piece of Broken Wall-plaster, Suet, Tallow, Soap, Candle, Hornware, Gelatine.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(*c*) **Scraped with knives** to remove hair, fat, flesh, and all **useless parts.** (*d*) Another **soaking** for about a week **removes the lime.** (2) **Tanning,** or making the hide into leather, is done by— (*a*) **Soaking** the prepared skins **in a tan-pit** for four or five months, whereby the **gelatine** in them is **converted** into tough **leather.** (3) The manufacture is completed by **currying**; that is, by— (*a*) Washing and **drying** in open lofts. (*b*) **Hammering** and **rolling** between heavy rollers to harden them. (*c*) The **thin skins** are **dressed with oil** and tallow, and rubbed **smooth**; then **blacked** with lamp-black and tallow, and rubbed, **smoothed,** and **polished again.**	(*c*) *Note* that **only** fibrous or **true skin** is of use—the top thin skin (epidermis) is useless. (*d*) *Inform* that the **lime** would be **injurious**—the soaking solution is fowls' dung and water. (2) *Explain terms*—a **tan-pit** is a deep tank in the ground, and filled with ooze; **ooze** is a liquor of water in which oak bark has been steeped; the bark (of oak, hemlock, and some other trees) contains **tannin,** the substance which **acts upon the gelatine.** (3) *Note* that (*c*) is really the **currying**; *exhibit* some "**upper leather,**" with one side black. *Exhibit* sole-leather, calf-skin, and dyed leathers used in **bookbinding.**
STAGE IV.—Recapitulate with added Information— (1) As **Dr. Jenner's discovery** of vaccination (1796): **Soap-making** with fats, and soda or potash: **Candle-making** by dipping the wicks in hot liquid tallow. (2) Thus are we indebted to cow for food, clothing, light, and cleanliness.	(1) *Derive* word **vaccination** from L. *Vacca*—"a cow." *Explain briefly* that the **alkali** does the actual cleansing by **softening and holding to the dirt** for the water to swill away; the **fat** being the **ready vehicle** by which it is conveyed to the dirt. *Exhibit* the **wick.** *Remind* how quickly **tallow cools.** (2) *Repeat* for emphasis, as a conclusion.

See Lesson V. of First Series.

IX.—USEFULNESS OF THE SHEEP

Objects and Apparatus.—Pictures of Sheep with Fleece on, and Sheared Sheep; Kid, Roan Leather, Parchment, Cat-gut; Bits of Wool, Skin with Wool on; Samples of Woollen Fabrics in great variety; a Piece of new fine Linen, a few Bristles, Worsted Threads, Yarn, Flock Paper.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture of Sheep, and of Objects.	
(1) The sheep is covered with a **thick coat of close crinkled hair called wool.**	By Observation and Experiment. (1) *Pass round* a sample of wool, and *guide to a perception* that it is a **kind of hair** which is **close, thick, soft,** and **wavy**; *say* that crisp hair so matted is **called wool.**
(2) This coat, called a **fleece**, can be **sheared while the animal is alive.**	(2) *Exhibit* pictures of a **sheared sheep** and of process of **sheep-shearing.** *Infer* thickness of fleece from apparent **thinness of sheared sheep.** *Exhibit* a piece of **skin with the wool on** it, as taken from dead carcase.
(3) **Wool** is of such a **nature** as permits of—	(3) *Have some* of the **fibres** of wool **drawn out,** and *pulled straight* to their **full length.**
(*a*) Its fibres being **woven** into **fabrics**:	(*a*) *Distribute* **samples** of blanket, flannel, broadcloth, worsted.
(*b*) ,, **matted** into **felt.**	(*b*) *Pass round* samples of **felt** carpet.
(4) All **woollen goods** give a **feeling of warmth.**	(4) *Feel* a piece of **linen,** and then a piece of **woollen,** on the sensitive **cheek-bone.**
STAGE II.—Wool Manufacture.	
(1) Before **shearing** the sheep are **washed** and dried; this is done in the warm **spring**; a fleece **weighs** about 7 lbs.	By Questioning, Telling, and Comparison. (1) *Question on* sheep shearing. *Make two points*, viz.:— (*a*) **Cruelty** of shearing in **cold weather.** (*b*) **Waste** of semi-barbarous nations who killed the sheep to take its skin, and made **clothing of sheepskin,** being ignorant of weaving.
(2) The wool is next **stapled,** or **assorted** according to length and quality.	(2) *Estimate* the **longer** staples or fibres at **five to eight inches.** *Feel* the fibres delicately with finger tips *to discover* the **rough, scaly surface.** *Explain* this as its **valuable characteristic** for manufacturing purposes, and *contrast* with **smoothness of bristle.**

USEFULNESS OF THE SHEEP—*Continued*

Objects and Apparatus.—Pictures of Sheep with Fleece on, and Sheared Sheep; Kid, Roan Leather, Parchment, Cat-gut; Bits of Wool, Skin with Wool on; Samples of Woollen Fabrics in great variety; a Piece of new fine Linen, a few Bristles, Worsted Threads, Yarn, Flock Paper.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(3) After being **scoured**, to rid of natural oil or **yelk**, the—	(3) *Memory will recall* existence of **natural oil** in animal **coverings**.
(*a*) **Long-staple** which is less curly and has fewer scales, is **combed** for making **worsteds and stuffs**.	(*a*) *Explain* that **combing** is done by **heated steel combs**. *Exhibit* damasks, alpacas, and poplins as **worsted stuffs**.
(*b*) **Short-staple**, which is very wavy and scaly, is **carded** for making **broadcloths**.	(*b*) *Explain* that **carding** is a preparation **for spinning** into yarn. *Exhibit* **broadcloths**, tweeds, blankets, &c. *Note* that **broadcloths**, as kerseymere, and cloth for livery uniforms, **are "felted" or "fulled."**
(4) The fibres are then **spun** into continuous lengths, called **yarns**, by spinning machines.	(4) *Explain briefly* this spinning or twisting into **threads** on the **spinning-jenny**. *Exhibit* some worsted threads.
(5) Machines called **looms** then weave the threads into **cloths**.	(5) *Illustrate* the interweaving of **warp** (threads longways) with the **weft** (threads crossways) by basket-work. *Note* how "**felting**" or "fulling" **obliterates** appearance of the **warp and woof**. *Distinguish* from the loom the **knitting frame**, which produces **hosiery**.
(6) The **cloth** is scoured and milled or **fulled** to make it shrink, thicken, and strengthen.	(6) *Explain* that scouring **rids of grease**. [lock. ,, ,, **fulling** is a beating process **to make scaly fibre inter-**
(7) There are various other **finishing processes**, as dyeing, pressing surface, raising nap, &c.	(7) *Samples* of materials in **great variety** *will serve to show* the many kinds of "**finishes**" to which woollen fabrics are subjected.
(8) Very short wool is not woven, but **felted** into a mass for making **carpets and hats**.	(8) *Summarise* processes of moistening and beating with rods till **fibres mat firmly together**. *Mention* that **wool refuse** dusted over paper makes "**flock**" wall-paper.
STAGE III.—Other Products and Uses of the Sheep.	BY QUESTIONING, TELLING, AND COMPARISON.
(1) The flesh of the sheep, called **mutton** (that of the young is called **lamb**) is most wholesome meat, (*a*) **not quite** so **nutritious** as beef, but (*b*) **more digestible**.	(1) *Question* on the **names** of flesh **meats**. *Tell* that whereas some countries **rear sheep** for the **wool**, we rear them for the **meat**; and *infer* **dense population**.

(2) The **fat** of the sheep, which is **abundant**, is all utilised—
  (*a*) **Suet** for puddings.
  (*b*) **Tallow** for (i.) **Lubricating** machinery.
    (ii.) Making **soap.**
    (iii.) Making **candles.**

(3) The skin is used for making "**kid**" gloves, and for **bookbinding.**
Lambskin makes **parchment.**

(4) The **entrails** are used—
  (*a*) When clean and fresh to make **sausage skins.**
  (*b*) When dried and twisted are called **cat-gut.**

(5) **Ewe-milk** is richer and yields more cream than cow's milk, and is made into **cheese** at Gorgonzola in Italy.

STAGE IV.—Recapitulation and Added Information.

(1) Wool is largely **imported** from Australia, New Zealand, and the Cape.

(2) The **seat of the woollen manufacture** is in Yorkshire, the Lowlands, and the West of England.

(3) The **climate** of these damp **northern latitudes** makes **woollen** clothing **indispensable.**

(4) To the sheep we are **indebted** for our **chief article of flesh food,** and our **chief material of clothing.**

(2) *Recall* extreme fatness of mutton—the excess of waste fat being **boiled into tallow.**
  (*a*) *Note* that suet is a **hard fat** which **soon** grows **cold.**
  (*b*) (i.) *Describe* greasing of **machinery,** for **smooth running.**
    (ii.) *Describe* **soap** as tallow mixed with soda, boiled and stirred, and with the water pressed out.
    (iii.) *Describe* **candles,** consisting of a wick which has been dipped into hot tallow, and cooled.

(3) *Distribute* specimens of "**kid,**" and of "roan leather," which is sheepskin grained to imitate morocco leather, used in **bookbinding.**
Admire the **durability of parchment** as a material for writing upon, which cannot be torn nor burnt like paper—*infer* its **use for important documents.**

(4) *Admire* economical propensity which finds **a use for everything.**
  (*a*) *Indicate* that "**sheep's ropes**" should be perfectly **fresh,** and thoroughly **cleaned** for this purpose.
  (*b*) *Distribute* bits of cat-gut. *Enumerate* its uses in various **stringed instruments.**

(5) *Make a passing allusion* to **Gorgonzola** cheese. *Infer* its **higher price** from the **smaller quantity made.**

By Questioning and Telling.

(1) *Infer* **vast grazing regions** from the vastness of the numbers of sheep reared.

(2) *Enumerate* **towns** and places **famous** for woollen products.

(3) *Mention* the **hygienic qualities** of woollen fabrics—(*a*) **bad conductors** of heat; (*b*) **good absorbers** of moisture (sweat); (*c*) they **gently chafe** the skin and give sensation of **warmth.**

(4) *Claim* **mutton** as highly popular, if not the chief of meats.
Claim **woollen cloths** as being in requisition for clothing **old and young**; for both **sexes**; for **underwear** and **outer garments.**

See Lesson VI. in Part I.

X.—POULTRY—(RARER SORTS)

Objects and Apparatus.—Pictures of Farmyard Poultry (Fowls, Ducks, and Geese), and particularly of Turkey, Guinea-fowl, and Pea-fowl, with Living Specimens of these three in Wicker Cages (if possible); Peacock Feathers.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictures (and Living Specimens).	By Observation and Experiment.
(1) Poultry is a name given to those **birds** which are **kept tame to supply** us with **food.**	(1) *Obtain* the **common name** "poultry," and the **generic names** "fowls," &c. *Obtain* the **use for which** they have been **domesticated.**
(2) All of them are **large of body,** and **weak of wing.**	(2) *Gather* that a **plump body** yields much **meat** to repay the trouble taken. *Infer* that **weakness of wing** signifies **disuse** of it in flying away from man, as wild birds, and that they have all **become completely dependent upon man.**
(3) They **vary much** in form, size, and colour; but **all** are **vegetable feeders** and live in **flocks.**	(3) *Allude but passingly* to the **commoner sorts,** which have been *previously dealt with.* *Announce* that attention will be directed mainly to **rarer sorts**—*obtain (or give)* their names, viz., turkey, guinea-fowl, and pea-fowl.
(4) The **turkey** is— (*a*) The **largest** of the scratching poultry.	(4) (*a*) *Differentiate* the **swimming poultry,** and *compare* with the largest of them, the goose. *Note* the strong **scratching claws,** and the formidable **spur.**
(*b*) It has a speckled **plumage.**	(*b*) *Note* also a **tuft of hairs** on adult male at base of neck.
(*c*) The head is covered with **naked red wattles,** from the top of which droops a **pointed comb.**	(*c*) *Explain* "naked" to mean **devoid of feathers.** *Compare* with **cock's comb.**
(5) The **guinea-fowl**— (*a*) Has a **strange appearance,** its body thickly **rounded** in the middle, and **tapering ovally** to a very thin neck at one end, and a short drooping tail at the other.	(5) (*a*) *Describe* this **strange** appearance, as its **features** are *pointed out.* *Indicate* a **large yield of meat** from a body so plump and rounded.
(*b*) Its **plumage** is dusky and **speckled,** and its head has **naked wattles.**	(*b*) *Compare* and *contrast* with **turkey.**

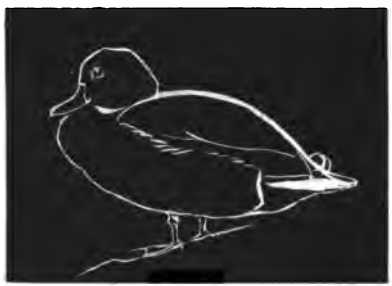
(6) The **pea-fowl**—

(*a*) Are known best from the **gorgeousness of the male** bird, the peacock.

(*b*) The **peacock** is among the **handsomest** of large birds, wild or tame.

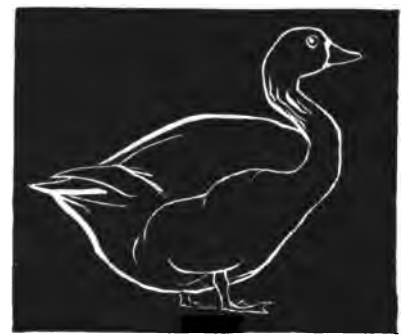
(6) (*a*) *Admire* the **brilliancy** of the peacock's **plumage.**
Exhibit some peacock tail feathers, with their "**jewelled eyes.**"

(*b*) *Compare* with the **duller-coated poultry** birds.



A Duck.

A Fowl.



A Goose.

(*c*) It has a "**crown**" of twenty-four upright feathers.

(*d*) Its gorgeous **tail** can be raised and spread **like a fan**, or **dropped.**

(*e*) The **peahen** is not so gorgeous, and is rather **less.**

(*c*) *Suggest* connection of this crown, and general splendour, with its title, "**king of domestic birds.**"

(*d*) *Explain*, as wall picture necessitates.

(*e*) *Note* her very **short train**, devoid of the beauties of her mate, and her **shorter crest.**

POULTRY (RARER SORTS)—*Continued*

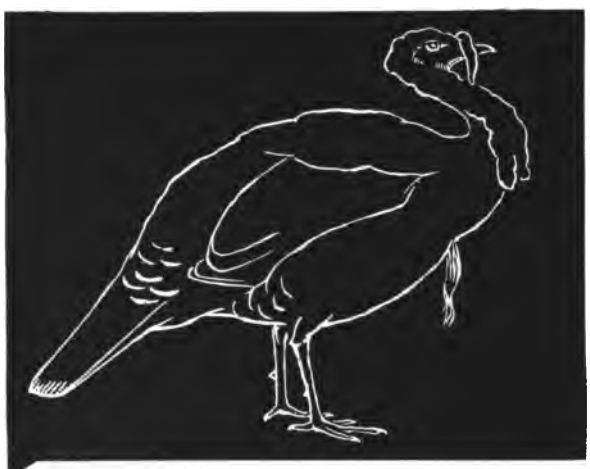
Objects and Apparatus.—Pictures of Farmyard Poultry (Fowls, Ducks and Geese), and particularly of Turkey, Guinea-fowl, and Pea-fowl, with Living Specimens of these three in Wicker Cages (if possible); Peacock Feathers.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE II.—The Turkey.	By Questioning, Telling, and Comparison.
(1) Turkeys soon **get friendly** with other poultry, but need a **roomy shelter-house.**	(1) *Infer* **roominess** of pen from large **size and heaviness** of birds. *Tell* that turkeys have **a wandering propensity**, and like to **roost** out in the **trees.**
(2) The turkey cock **struts** about the farmyard as if **puffed up** with conceit, and with its **comb often swelling** with anger.	(2) *Depict* the ridiculous behaviour which it often indulges in, being **quarrelsome.** *Imitate* its "**gobble,**" uttered loud and fast.
(3) Turkeys are **fed on grain and meal;** their **flesh is richer** than that of fowls.	(3) *Recall* recollections of the **Christmas turkey.**
STAGE III.—Guinea-fowl.	By Questioning, Telling, and Comparison.
(1) Guinea-fowl are **troublesome to rear,** needing more constant care, and better feeding than barn-door fowl.	(1) *Account for* need of **delicate rearing** by stating that this bird **came originally** from **hot** marshy **lands** of Guinea. *Tell* that they **refuse to sit** on their own eggs; and that **if left** but a **few hours without food,** they **die.**
(2) They retain their **original wandering habits,** but **seldom** get **lost** owing to their peculiar shrill and **frequent cry.**	(2) *Tell* that they still prefer to **roost in trees,** and often have to be **coaxed into the fowl-pen.** *Tell* that there is a **similarity** in the **cries** of the guinea-fowl and the pea-fowl.
(3) The **flesh** is esteemed for its **delicate flavour.**	(3) *Put forward* this as the only **reason for taking trouble** to rear them
STAGE IV.—Pea-fowl.	By Questioning, Telling, and Comparison.
(1) Pea-fowl get their names from a **French word** *paon*, the cry of the bird.	(1) *Pronounce* "pahn,"—*paon* is also the **French name** for peacock.
(2) The glory of the peacock is the **brilliancy of the blue** on the **breast,** and the **magnificence** of the **spread tail.**	(2) *Paint in admiring words*, as they are pointed out— (*a*) The **metallic lustre** of the neck. (*b*) The exquisite tint known as **peacock blue.** *Explain* that the "**spread tail**" is scarcely a correct description of this magnificent effect, as the tail itself when trailing behind consists

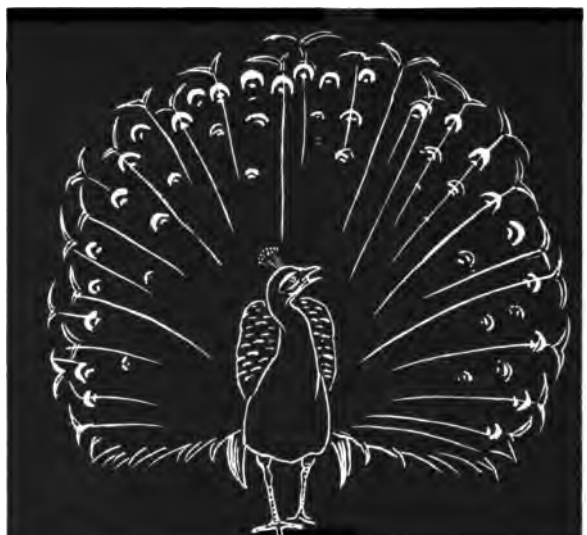
(3) The peacock **struts** in **pride**, and in **anger clatters** its **feathers**.

of **eighteen quills**, but when expanded fan-shape it includes the "**tail coverts**" also.

(3) *Quote* phrase "**proud as a peacock.**" [tail.
Compare the **clatter** of feathers, with the angry **rattle** of rattlesnake's



A Turkey.



A Peacock.

(4) The peacock is **kept** not because it is useful, but simply for **ornament**; yet the **flesh** of peafowl is **excellent eating** like that of other fowl.

(4) *Describe* as a beautiful **living ornament** to gentlemen's **lawns**.
Tell that the peacock was in olden times accounted **a royal dish** in England. [**ordinary food**.
Surmise that the **costliness** of the bird **prohibits** its use as an

POULTRY (RARER SORTS)—*continued*

Objects and Apparatus.—Pictures of Farmyard Poultry (Fowls, Ducks, and Geese), and particularly of Turkey, Guinea-fowl, and Pea-fowl, with Living Specimens of these three in Wicker Cages (if possible); Peacock Feathers.

MATTER SUMMARISED.

STAGE V.—Recapitulatory and Additional Information.

(1) In recapitulation, *tell* that—
- (*a*) Our turkeys were derived from America.
- (*b*) Our guinea-fowl were derived from Africa.
- (*c*) Our pea-fowl were derived from Asia.

None of them **are natives of Europe**, nor yet are our barn-door fowl (Asiatic).

(2) *Gather* their **common attributes**—
- (*a*) All are vegetable **feeders**.
- (*b*) All have large **bodies**, short **wings** and **tails** (which latter vary).
- (*c*) All have long **legs** and strong rough **toes**.
- (*d*) None of them **sing**.
- (*e*) None build **nests**.

DETAILED HINTS AND SUGGESTIONS.

By Questioning, Telling, and Comparison.

(1) Resultants are—
- They have become **acclimatised**.
- They have become **domesticated**.
- They thrive with **health** to themselves.
- They thrive with **profit** to us.

(2) *Dwell on* features which are common.
- (*a*) *Gather* names of **poultry foods**.
- (*b*) *Question* on **variations** in tail **formations**.
- (*c*) *Designate* "**scratchers**."
- (*a*) *Gather* the **various cries** (crowing, gobbling, &c.).
- (*e*) *Gather* that they **merely** scratch together a **bit of grass** or straw.

See Lesson IX. in Part I.

XI.—TAME AND WILD

Objects and Apparatus.—Pictures of Animals, classed as Tame and Wild, and brought into use as named; Animal Products, all properly labelled, brought into use as named.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—The Differences between Tame and Wild Creatures.		
(1) Animals are **tame and wild.**	Questioning and Memory.	(1) *Ask* for **names** of animals which are **tame,** and for those of **wild** animals.
(2) **Tame** animals are those which **depend** upon us for their **food and shelter.**	,,	(2) *Question* on the way **canaries** are fed and sheltered—*contrast* with **sparrows.**
(3) They are **docile and quiet,** and have been domesticated because they are of **some use to man.**	,,	(3) *Question* on **docility.** *Distinguish* between those which are **merely docile** (as cow) and those which **develop attachments towards man** (as dog). *Question summarily* on **uses.**
(4) **Wild** animals are those which **find** their **own food and shelter.**	,,	(4) *Question* on difference between **wild rabbits** and **tame rabbits.** *Make* these **typical** of others.
(5) These have been **left** in their **wild** state because man has **not** found it **worth** his **time to tame** them; they are generally **shy and timid,** or **fierce and dangerous.**	,,	(5) *Question* on those **left wild** (*a*) because they **thrive better** so (rabbits); (*b*) because they are **useless to man** (mice); (*c*) because they are **fierce and dangerous** (lions).
	Telling.	*Add a few words* on the **pleasure** conferred upon us by **feathered songsters** and other **wild birds.**
STAGE II.—The Uses of Tame Animals.		
(1) Some animals have been domesticated **to supply man** with **food.**	Telling.	(1) *Use* word **domesticated.** *Explain* it to mean "living round our houses," and derived from L. *domus,* "**a house.**" *Elicit* list of domestic **animals kept** for our **food** supply.
(2) Some domesticated animals **supply** man with material for **clothing.**	,,	(2) *Suggest that* man originally **hunted for food,** and utilised **skins** of his victims **to clothe** himself. *That* when he had **domesticated** an animal like the **sheep, he** obtained **food and clothing** without **effort.**

Objects and Apparatus.—Pictures of Animals, classed as Tame and Wild, and brought into use as named; Animal Products, all properly labelled, brought into use as named.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		That as man became **more civilised,** he sheared the wool and spun it, and thus obtained his **clothing without wasting the life** of the animal. *Note that* **sometimes** the animal is **fed solely** to supply **clothing** (as silkworm and Australian sheep).
(3) Some animals have been tamed **to work for man.**	Questioning. Telling. Questioning.	(3) *Question for* **names of beasts of burden** (horse, ass, and sometimes the ox; also elephant and camel in far countries). *Describe briefly* the **catching** and taming of wild **elephants.** *Question for* names of **animals which hunt** for man, and **assist** him **in other ways** (falcons, hounds, and shepherd dogs).
(4) And some creatures are kept tame for **companionship,** or for **ornament.**	,,	(4) *Question out* **uses** of dogs, **cats, canaries,** peacocks, **goldfish.** *Refer* to **Robinson Crusoe's pets,** and the **need** he had **for them.**
STAGE III.—Useful Animals (Tame and Wild).		
(1) Among the animals which have been **domesticated** are— (*a*) **Mammals.** (*b*) **Birds.** (*c*) **Insects.**	Telling. Supplemented by some Questioning and the Examination of Objects.	(1) *Announce* that the **domesticated creatures** will now be asked for **under their different classes** (beasts, birds, insects). (*a*) *Enumerate* through *class questioning* (cow, horse, dog, goat, pig); **also their products,** as butter, cheese, wool, meat, bone-ash for pottery, hoofs, horns. (*b*) *Enumerate* the **poultry** tribe; the **ostrich,** farmed for feathers; **also their products,** as eggs, feathers. (*c*) *Enumerate* **bees** for food-stuff (honey), and a useful material (wax); **silkworms** for a clothing material (silk, satin, ribbon, and velvet). *Note that* **reptiles are not domesticated** as they are (i.) useless, and (ii.) often dangerous.

(2) Among the **wild animals** systematically **hunted** for some **useful products**, are—

(*a*) **Mammals** yielding **furs**.
(*b*) **Mammals** yielding **other material**, as—
  (i.) Elephants for ivory.
  (ii.) Musk-deer for musk.
  (iii.) Whales for whalebone, spermaceti, and ambergris.

(*c*) **Birds** yielding **feathers**.

(*d*) **Insects** also are sometimes **collected** for use.
(*e*) While the **fisheries** are constantly worked for man's benefit, as—
  (i.) Food fisheries, round the coast.
  (ii.) Pearl and sponge fisheries afar.

Note that **fishes** can strictly be said to be domesticated, for **golden carp** may be fed, but **little else can be done** with them.

Note that **oysters** are cultivated (oyster beds at mouth of Thames), but they are soft-bodied creatures, **practically** left to a **natural life.**

Summarise the facts that domestic creatures are (i.) generally the **higher animals** which (ii.) possess some considerable **intelligence.**

(2) *Recall that* **some** animals—
  (i.) Do **not thrive** in captivity, or
  (ii.) Are **too dangerous** to keep round our houses.
} *Class to name examples of each.*

Gather that **yet** some of these **wild creatures yield** such useful **material** that they are regularly **hunted.**

(*a*) *Class to enumerate ;* as sable, beaver, chinchilla, seal.
(*b*) *Tell* elephant **ivory** is distinguished by lozenge-shaped markings ; hippopotamus ivory is inferior.
Tell this **musk** is obtained from abdomen of musk-deer of Siberia.
Tell **whalebone** is got from mouth of Greenland whale, and **train-oil** from its blubber. **Spermaceti**, a waxy oil, is obtained from sperm whale ; and also **ambergris**, used in perfumery.
(*c*) *Obtain* **ornamental feathers** as from ostriches and wild fowl ; **eider-down** from eider duck of North Europe.
(*d*) *Merely name* **cochineal**, used for red dye ; and **Spanish fly**, used as a blister in medicine.
(*e*) (i.) *Question on* **fish-food** supply.

(ii.) *Question briefly* on **pearls** and **sponges**, and how obtained.

*** *In this stage*, as each animal product is dealt with, *specimens should be distributed.*

TAME AND WILD—*Continued*

Objects and Apparatus.—Pictures of Animals, classed as Tame and Wild, and brought into use as named; Animal Products, all properly labelled, brought into use as named.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE IV.—Recapitulation and Additional Information.		
	Questioning and Comparisons.	In *recapitulatory review* it may be shown how the **tame creatures** (*a*) have been **tamed**, and then (*b*) **acclimatised** in parts distant from original home.
Cultivated plants are those which man has found useful; and they **correspond** with the **domestic animals** he cultivates.	,,	*Comparisons may be questioned out*, as between— Wild **creatures** and wild **plants**; Tame **creatures** and cultivated plants; Creatures tamed, and plants cultivated for **food** (grains and fruits); ,, ,, ,, ,, **clothing** (cotton); ,, ,, ,, ,, **useful products** (dye plants); ,, ,, ,, ,, **ornaments** (flowers).
	,,	*Realise* how **savage** man, without domestic animals and cultivated plants, leads a **hard life**.

XII.—FEATHERED GAME

Objects and Apparatus.—Pictures of Pheasant, Partridge, and Grouse (to same scale), or Stuffed Specimens; Ornamental Tail Feathers of Pheasant and Black Grouse, as used for trimmings; some Heather; a Fowl's Gizzard; Pictures of Quail, Capercailzie, and Ptarmigan; a Ptarmigan's Foot.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictures (or Specimens).	By Observation and Experiment.
(1) All these birds bear a **general resemblance to** the ("scratching") **poultry** in—(*a*) general **shape** of body and wings, and (*b*) **structure** of bill and feet.	(1) *Take* the **turkey** and the **hen** *for comparison.* *Obtain* that these are not tame, but **wild birds**, found in **England**; have them *named.*
(2) The **pheasant** has **bright plumage**, chiefly a mixture of bright browns spotted and **banded**, the **neck** being beautiful in its **glossy shades** of blues, greens, and purples. The **head** is covered with a **warty skin**, and the **tail of the male bird** is very **long.**	(2) *Point out* the various **shades from yellow** to red, brown, and black on the body; and the **reflected tints** of the neck—greens, blues, browns, and purples. *Note* **shorter tail** and duller plumage of **hen**, and that the **male's tail** is **twice as long** as his body.
(3) The **partridge** (*a*) is **not so large** as the pheasant, and its plumage is **not so bright.** (*b*) Its short **round body** is covered with a **greyish and reddish-brown** plumage.	(3) *Note* also the **very short tail**, and short sharp bill. If a *front view* of the bird is given, *observe* the chestnut **horseshoe patch** on lower breast.
(4) The **common grouse** has a plumage of **chestnut-brown**, with **zigzag bars and dots** of black.	(4) *Note* that partridge and grouse belong to **same family** of birds.
STAGE II.—The Pheasant.	By Questioning, Telling, and Comparison.
(1) Pheasants live wild in our **woods**; they run about beneath the **thick undergrowth** like poultry, but **take wing** when disturbed; they **roost** on the **trees.**	(1) *Distinguish* all these **game birds** as being wild, **finding their own food and shelter.** *Mention* that pheasants **require** dense **cover** and plenty of **water,** and generally **decrease** unless cared for.
(2) The hen makes a **loose nest** of grass and leaves on the ground, and lays about twelve brownish eggs.	(2) *Compare* with **domestic poultry**, whose nests are all **rudely scraped together** on the ground.

FEATHERED GAME—*Continued*

Objects and Apparatus.—Pictures of Pheasant, Partridge, and Grouse (to same scale), or Stuffed Specimens; Ornamental Tail Feathers of Pheasant and Black Grouse, as used for trimmings; some Heather; a Fowl's Gizzard; Pictures of Quail, Capercailzie, and Ptarmigan; a Ptarmigan's Foot.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(3) The **cock** pheasant **takes flight** more readily than the hen bird.	(3) *Offer* the nickname "**long tail**" for a cock pheasant—it is catchy and descriptive.
(4) They **feed** on berries, seeds, roots, young shoots, worms, and insects.	(4) *Infer* these articles of **diet** from **habits** of the bird.

A Pheasant.

(5) Pheasants are **shot** from October 1st to February 3rd; their **flesh is richer** than that of fowl, and they **fetch a higher price** than chickens.	(5) *Tell* that the **law** fixes these dates, and that even the rich owner of the "**preserves**" may not shoot his own birds during the "**close**" **season.** *Reason out* the **necessity** of this legal strictness—to **protect** the birds during breeding season and **save from extinction.**

STAGE III.—The Partridge.

BY QUESTIONING, TELLING, AND COMPARISON.

(1) Partridges **flourish** most where **agriculture is most advanced**, and are found running about fields and hedgerows in **all parts** of the country.

(2) They **feed** on grain and other seeds, insects and their grubs, especially those of ants.

(1) *Contrast* this **life in the open** with the **covers** needed by the pheasant.
Note that the partridge is found, both in **greater abundance** and **wider area**, than other two.

(2) *Compare* with pheasant.

A Partridge.

Foot of Ptarmigan.

(3) The **nest** is usually on the ground in brushwood or long grass, corn or clover; it contains from fourteen to twenty eggs.

(4) Partridges are **gregarious** except at breeding season; late in the season several broods or **coveys** unite and form what is called a **pack**.

(3) *Describe* the startling **whirring** noise with which they rise on the **wing** when disturbed by any one walking across the field.

(4) *Explain* the word "**covey**" as a special name for one **family** (parents and brood) of partridges.
Explain "**season**" as the **autumn**.

Objects and Apparatus.—Pictures of Pheasant, Partridge, and Grouse (to same scale), or Stuffed Specimens; Ornamental Tail Feathers of Pheasant and Black Grouse, as used for trimmings; some Heather; a Fowl's Gizzard; Pictures of Quail, Capercailzie, and Ptarmigan; a Ptarmigan's Foot.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(5) At dusk they roost or **jug** on the ground, under **leadership** of the oldest cock, who calls them together at **sunset** with a **shrill cry.**	(5) *Compare* with other **gregarious animals** who place themselves under **leadership of oldest male**—as sheep and buffaloes.
(6) The birds then settle down some **distance apart,** in a **circle**, and all **facing outwards.**	(6) *Question* on the **security** of this arrangement, back to back, whereby **no danger** can approach from any side **without** one bird giving **warning.**
(7) The partridge shooting **season** begins September 1st and ends February 1st.	(7) *Compare* with pheasant season. *Value* at 4s. a brace as **average price**, and *compare* with the larger birds (pheasants) at 7s. a brace.
STAGE IV.—The Grouse.	BY QUESTIONING, TELLING, AND COMPARISON.
(1) The grouse is **wilder** in its habits, and is found only in very lonely places, in this country such as the **moorlands** of the north.	(1) *Take* a map of **England**, draw **line** across from the Humber to the moorlands of Wales, and say that no grouse are found **south of that.**
(2) Grouse **feed** on the shoots of heather, fir, and pine; and on seeds and berries of mountain plants; and on insects.	(2) *Infer* wildness of **habit** from nature of **food.**
(3) Grouse **shooting** commences on August 12th and ends on February 1st.	(3) *Refer* to **legal restrictions.** *Ask for* the order in which **the three shooting seasons** commence, and **why** they all **end** about **February.**—(Breeding season begins.)
STAGE V.—Additional Matter.	RECAPITULATORY.
(1) All the **poultry tribe** have **beaks** which are **not strong enough** to crack the seeds on which they feed, and **so are provided with gizzards.**	*Recapitulate* to relate all these facts to each other, and to *re-arrange* them in proper order. *Then may be added*—
(2) Our **barn-door fowl** belong to the **pheasant family,** and so does the **peacock,** all coming	(1) *Exhibit* a fowl's **gizzard,** with the **grit** still in it. *Compare* with a **mill** or with our **grinding teeth.** *Contrast* with strong beak of **parrot.**
	(2) *Note* **similarity** (particularly of "**pheasant breed** of fowl") between "tame" poultry and the "wild" pheasant family.

from Asia. Also the **turkey** from America and the **guinea-fowl** from Africa.

(3) The **grouse family** not only includes the grouse itself and **partridges**, but the little **quail**, and the big **capercailzie**, and the **ptarmigan**.

(4) All these birds are **plump** and yield well of meat for **human food.** They all have to be **hunted**, and are therefore called **game**—or "feathered" game to distinguish from "furred" game.

(3) *Note* beside the red grouse or common grouse—

(*a*) The black grouse or **black cock**, with its **forked tail**, found abundantly in Scotland.

(*b*) The **capercailzie**, or cock of the wood, sometimes as **large** as a turkey; found all over Northern Europe, and formerly in Scotland and Ireland.

(*c*) The **ptarmigan**, with its **feet** thickly covered with hair-like feathers, and which **changes** its dark plumage **to white** in the winter, as the ermine changes its fur; found in Northern Europe and extreme north of Scotland.

(*d*) The **quail**, found in South Europe, and **flocks** of which **visit England** in the summer.

(4) *Contrast* **small** amount of **bone** with the **yield** of **meat.**
Describe the **sportsman's methods** with dog and gun.
Name some **examples** of furred game.

XIII.—VERMIN

Objects and Apparatus.—Pictures of Voles, of Sparrows, and of Cockroaches; and Dead Specimen of each.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Introduction.	
(1) Certain small **creatures**, which are **more destructive than useful**, we do not encourage; they are **called vermin.**	By Questioning and Telling. (1) Where do we **store food** in our **houses?**—(**Pantry.**) Where do farmers **store grain?**—(**Barns.**) What small animals often **find out such stores** of our food and eat it?—(**Rats** and **mice.**) Why do we **not like** these animals?—(They **destroy so much** of stuff we value.) Are these animals of **any use** to us?—(**No.** Or if some scholar gives a **minor use** for them, the teacher must demonstrate

VERMIN—*Continued*

Objects and Apparatus.—Pictures of Voles, of Sparrows, and of Cockroaches ; and Dead Specimen of each.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
	that their **destructiveness outweighs** their **utility.**) Therefore do we encourage them, or **try to get rid** of them?—(Rid.) **What name** do we give to these destructive creatures?—(**Vermin.**)
(2) **Vermin** are generally **small** creatures, and include **birds** and **insects**, as well as **mammals.**	(2) *Instance* **birds** which, when allowed to increase in excessive numbers, **do damage** to growing **grains** and **fruit**, and to **rickyards**; **moths** that injure **fabrics.**
Sparrow's Beak.	*Make but a passing allusion* to the **body vermin** found on very dirty persons.
	Prove that **rabbits** are **wrongly classed** when called vermin because of their destructiveness to growing crops. Rabbits **can be profitably caught** and killed for food, as is the case even in Australia, where they became a plague, but are now largely canned for exportation.
(3) **Creatures** which at **ordinary times** are **tolerated**, as soon as they **increase** so much as to **become pests**, are destroyed as **vermin.**	(3) *Announce* that **an example of each** class of vermin will now be examined, viz., one mammal, one bird, and one insect as typical of others.
STAGE II.—Examination of Pictures and Specimens.	
	By Observation and Experiment.
(1) The **vole**, or field mouse, is a pretty **little creature** with red **back**, grey **belly**, short **ears**, blunt **nose**, short **tail**, and sharp **claws.**	(1) *Point out* separately these **various features.** *Experiment* by placing a **clod** of reddish earth against the red-brown **fur**, to show how **difficult** it is **to distinguish** one colour against the other.
(2) The **sparrow** is a well-known **little bird, brown** and ash-grey, **streaked** with **black**; the **tail** is of moderate length; **wings** rather long.	(2) *Show* that the **silvery grey** parts are **underneath,** and the brighter **browns above.** *Contrast* size and direction of **tail** with that of **other birds** (pictures of blackbird, wren, &c.).
(*a*) The **bill** is short and strong.	(*a*) *Illustrate* by a cone, and call it a "**cone-bill**"—**strength indicated** by shortness and breadth of base.

(*b*) The short slender **legs** have **four toes**, three forwards and one backwards.

(3) The **cockroach** is a **reddish-brown insect.** The **males** only have **wings** (two pairs).

(*a*) It has long, tapering, pointed **feelers.**

(*b*) It has large oval (compound) **eyes** near roots of the feelers.

(*b*) *Indicate* the **grasping power**, and *call* it a **percher.**

(3) *Examine* males and wingless females; *observe* the body "**cut into**" three parts, and the possession of **six legs characteristic** of insects. *Observe* that though commonly called a "black-beetle," it is **not "black."** *Say* it is **not a "beetle,"** because all beetles, male and female, have two sets of wings.

(*a*) *Mark* their delicacy, as if for **delicate feeling** in the **dark.**

(*b*) *Experiment* by **flashing a light** in front of live specimen, and note it **scurry away** towards some dark corner.

Smell the disagreeable **odour** of cockroaches.

STAGE III.—Structure and Habits.

(1) The **vole** is **plentiful** in the **fields**, especially low-lying marshy ones.

(*a*) It **escapes observation** because—

(i.) It moves by a **smooth glide** rather than a walk.

(ii.) It is almost **invisible against** the **soil.**

(*b*) It is **more nocturnal** than diurnal in habit.

(*c*) The **winter nest** is below ground, with a **storehouse** for hips and cherry-stones, although it does **not hibernate**; the **summer nest**, where the **young are reared**, is placed on the ground, **concealed** in grass or corn.

(2) The **sparrow** is very **hardy**, and thrives anywhere, in **town or country.**

(*a*) It **breeds fast**, and **nests** in walls or in trees.

(*b*) It eats **insects during summer**, but at **other seasons grains**, seeds, and buds are chiefly eaten.

(3) The **cockroach** feeds on scraps, crumbs, and **waste food left about**, and will sometimes attack boots, clothing, and ropes; but it **always shuns** the light.

BY QUESTIONING, TELLING, AND COMPARISON.

(1) *Distinguish* from common **house mouse**, from long-tailed **wood mouse**, and **harvest mouse** with prehensile tail.

(*a*) *Tell* how a mouse has been **mistaken for a patch** of red **earth**, till it has been seen to change its position.

Revert to experiment with the earth against the red-brown fur.

Note its longish fur, and almost tufted tail—as for warmth.

(*b*) *Infer* that it **comes out** in the **evening.**

(*c*) *Tell* that they **increase very fast**, several broods of five or seven in the year.

Tell that they are fond of **hips**, and can nibble into **cherry-stones** with chisel-edged teeth quite easily; that they are destructive to beet, Brussels-sprouts, and other garden stuff.

(2) *Recall* to memory how **ubiquitous** is this perky, impudent bird, yet **always wary.**

(*a*) *Obtain* **nesting places.** Tell that it breeds from February to September, **brood after brood.**

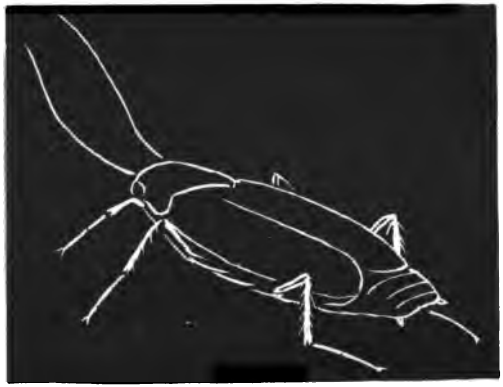
(*b*) *Obtain* that only in **summer** are **insects** to be found. *Remind* of its **destructiveness** of **buds** and **seedlings** in our gardens.

(3) *Glean* from children all they have observed of its **habits**; how it is a **"light shunner,"** frequenting **kitchens** after dark, and scurrying away as soon as a light is taken in.

VERMIN—*Continued*

Objects and Apparatus.—Pictures of Voles, of Sparrows, and of Cockroaches; and Dead Specimen of each.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE IV.—Conclusion.	
(1) Many animals **act as a check upon others**; when a check is **removed,** then the others increase too rapidly, and become a **nuisance.**	(1) *Apply* this **natural law**— (*a*) *Generally*, by discovering **some** of the beasts, birds, fishes, and even insects that **prey on others.** (*b*) *Particularly*, by discovering **some** of the beasts and birds that **prey on voles** and **sparrows** (hawk, owl, domestic cat, weasel, &c.).
(2) In **districts** where hawks and owls, and similar **birds of prey**, have been **ruthlessly shot,**	(2) *Describe* the **destruction of crops** and **invasion of barns** in various districts where the voles have grown into a **plague.**



A Cockroach.

A Field Mouse or Field Vole.

there **voles and sparrows** have increased, and become **a nuisance.**

(3) In houses and other **buildings** where there is **neglect,** such **insects** as cockroaches **increase** till they **become a pest.**

(4) Therefore the lessons to be learnt are—
To be clean in all our **surroundings.**
Not to interfere in the outdoor world, so as **to destroy nature's own balance.**

Describe the **depredations** of sparrows **where** their numbers have made the **struggle for existence severe,** and where they eat up seedlings in **spring,** fruit in **summer,** and grain in **autumn.**

(3) *Glean*—
(*a*) That cockroaches are **objectionable** at all times from their disagreeable **odour.**
(*b*) That the best **remedy** is **cleanliness**—leaving **no scraps** in chinks and **dark corners.**
(*c*) That as they shun the light, it is well to **let in light** everywhere possible.

(4) *Drive home* these **two lessons,** one personal and the other external.
Refer to **body vermin** and **household vermin** as result of neglect and uncleanliness.
Instance the case of sparrows—they feed on grubs and insects—in moderate numbers protect our plants, and in turn they are eaten by owls and cats—in excess they become a nuisance.
Deduce that there is a balance in nature with which man cannot interfere without bringing trouble on himself.

XIV.—PREYING

Objects and Apparatus.—Pictures of Creatures of Prey (assorted); Prepared Jawbones and Teeth.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Introductory.	MAINLY BY QUESTIONING, SUPPLEMENTED BY TELLING.
(1) Some animals live on **animal food,** and some on **vegetable food.**	(1) *Ask for* names of **flesh-eaters,** and of **grass-eaters.** If **insect-eaters** are given, *accept* them, but *reserve* for separate treatment. *Ask for* some which **eat both kinds** (man, domestic dog and cat, bears, badgers).
(2) The **teeth formation** of an animal **shows** what kind of food it eats.	(2) *Question* on the **uses** of **front** cutting and **tearing teeth** (as of **cats**), front **gnawing teeth** (as of **rabbits**), front cutting **teeth and pad** (as of **cows**); of long sharp **pinning teeth** at the side (as four canines of dog and cat); of flat **grinding teeth** (as of man, horse).

PREYING—*Continued*

Objects and Apparatus.—Pictures of Creatures of Prey (assorted); Prepared Jawbones and Teeth.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
	Illustrate cutting-teeth by **chisel or shears**; grinding teeth by **mill-stones.** *Allude* to the **crunching teeth** for bones (dogs and hyenas); and to the **jaws** which move **sideways** (cow). *Note* that there are some animals **toothless**, as ant-eaters, which **feed on soft-bodied insects**; **birds** have **no teeth**; that **fishes and reptiles** have simple **pointed teeth turned backward** to prevent escape of prey. *Exhibit* **specimen jaws and teeth**, introducing as each of the three kinds of teeth come under notice.
(3) **Wild creatures** that are flesh-eaters **have to catch the animals** they eat.	(3) *Distinguish* **domestic animals** for whom food is **provided.** *Compare* preying of animals with the **hunting of man.** *Contrast* animals which will eat only **freshly killed prey** (lions) with those which prefer **carrion** (dogs, carrion crows). *Refer* to **jackals** which eat up **remains** of lions' prey; and to **snakes** which eat only **living prey.**
(4) Creatures **which catch their food** alive are called **beasts of prey.** (*a*) There are **beasts** (mammals) of prey. (*b*) ,, **birds** of prey. (*c*) ,, **fishes** of prey. (*d*) ,, **insects** of prey.	(4) *Define* prey as "food **caught alive.**" (*a*) *Enumerate*—as **lion**, wolf. (*b*) ,, **owl**, eagle. (*c*) ,, **shark** (sea), **pike** (fresh-water). (*d*) ,, **dragon-fly** which preys on weaker insects. *Note* to (*c*) that many fishes **prey on the eggs** of others. *Note* to (*d*) that creatures which **prey on insects** are merely called "insect-eaters" (as swallow, frog), and these either **sleep** or **migrate** in the **winter** season when no insects are abroad. *Enumerate* the **birds which feed** on insects and larvæ (wrens, tits). *Mention* the well-known **lady-bird**, which devours the **plant lice** (aphides) known as the "Blight."

STAGE II.—Methods of Preying.

(1) Some beasts **capture** their prey by **stealth.**

(*a*) Some **hunt** only by **night.**

(*b*) Some **approach** their prey **under cover** of their own colouring.

(2) Some animals **combine in packs, and run down** their prey by fleetness or endurance.

(3) Some creatures not only kill for themselves, but **devour** other **dead carcases.**

(4) Some creatures **overtake** insect prey by **superior flight.**

(5) Some animals **dig up** worms and insects to eat.

MAINLY BY TELLING, SUPPLEMENTED BY DRAWING UPON THE MEMORY.

(1) *By questions obtain* an example of the **cat kind.**

Question out the uses of **padded feet,** noiseless crouching approach, supple limbs.

Refer here to **noiseless flight** (soft plumage) of **owls.**

Refer here to lithe, long bodies and small heads for pursuit, of the stealthy and relentless **weasel tribe** in **following up small prey.**

(*a*) *Question* on the adjustable **eyes** of the **cat tribe,** specially adapted to **nocturnal** prowling.

Question on the **dark furs** of rats and mice, by which they **escape observation** in the gloom.

(*b*) *Instance* the **tiger,** whose vertical black **stripes** on a **tawny ground** correspond with the **yellow jungle grass** and the **shadows** between, thus making the crouching animal difficult to observe.

(2) *Instance* the dog tribe; as—

(*a*) **Hounds** that hunt for man's sport.

(*b*) **Wolves** that pursue their prey in howling packs.

Note that these "**give voice**"; and *contrast* with **silent** and **solitary stalking** of cat tribe.

(3) *Instance* the **vulture,** a great bird which **scents** a carcase **from distances,** and frequents **battlefields.**

Instance the **hyena,** which enters **villages** to devour the **offal,** crunching up the very **bones.**

The **jackal** and the **carrion crow** have been *already mentioned—say* that the first three belong to **distant** and warmer **countries** than ours, but the crow is an **English bird.**

Instance **crabs,** which eat each other, and devour the **garbage of the sea** along the shores.

(4) *Instance* the **swallow** (by day) and the **bat** (by night).

Instance the **dragon-fly,** a veritable "dragon" of the air, with great devouring jaws.

(5) *Question* on digging powers of the **mole,** and *contrast* with **rabbit,** which digs only to make its burrow. Tell how **blackbirds** and **thrushes** root up **cockchafer grubs,** and rooks dig worms.

Mention how **snails** are obtained by **throstles** dropping the **shells on hard stones** to break them.

PREYING—*Continued*

Objects and Apparatus.—Pictures of Creatures of Prey (assorted); Prepared Jawbones and Teeth.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(6) Some creatures **set traps** to catch their prey.	(6) *Question* on the purposes for which the **spider** makes its **web** (to entrap flies). *Mention* the **shrike**, a bird which **not only preys** on beetles, and even small quadrupeds like field voles, but has the curious **habit of sticking them on thorns** and eating them bit by bit, as disposed.
(7) Some creatures actually **shoot at, angle for,** or **fascinate** their prey.	(7) *Question* on the **frog**, and its method of **darting** its **flail-like tongue** at its insect prey. *Mention* the **angler** or fishing frog, which **angles** with bony **threads** sticking up from its head, easily **mistaken for worms** by the little fishes in the muddy sea-bottom. *Describe* how **snakes** are said to stare at **birds** till they **paralyse** them, and strike at them when thus **incapable of moving** away.
STAGE III.—Recapitulation and Conclusion.	By *recapitulatory questioning*, *review* the main points of the Lesson. *Additional information may consist* of the various **means** by which the **victims** seek **to escape** being preyed upon— (*a*) **Protective mimicry** (insects assuming shape and colour of inanimate objects). (*b*) **Hiding-places** (burrows—the **cuttle-fish** discharges ink to escape in darkened sea). (*c*) **Defensive organs** (horns), and **flight**—the "**flying fish**" rises into the air to escape.
In the animal world numberless creatures seem to exist **to eat**, and **to be eaten** by other creatures.	*Arrive* at the conclusion set forth in the Matter. *Illustrate* by the facts that **we eat chickens**, and **chickens eat grubs** and insects; and that **frogs** eat **flies**, and **snakes** eat **frogs**, and **hedgehogs** eat **snakes**.

XV.—HUNTING

Objects and Apparatus.—Pictures of Furred and Feathered Game (British), and of Noxious Animals hunted to Destruction; also as many Specimens as possible of the Animal Products of Commerce obtained by Hunting.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictures and Objects.		
(1) Many **useful things** can be **obtained** only by **hunting.**	Observation.	(1) *Distribute* **specimens of animal products** obtained by hunting; as furs, ivory, whalebone, sponge, mother-o'-pearl, animal oils, &c. —all **properly labelled.** [See "Tame and Wild," Stage 3 (2).] *Scholars examine* each article and pass it on—*note* its nature; be particular the label attached should **name it**, specify its **uses**, and state **from what animal** obtained.
(2) **Wild creatures** whose **flesh** is used for **food** can **only be obtained** by hunting; they are known as **game.**	,,	(2) *Direct attention* next to pictures of British **mammals and birds** classed as **game.** *Include* stag (venison), hare, rabbit, pheasant, partridge, grouse, woodcock, &c.
(3) **Some** wild animals are **hunted to get rid of** them, because they are destructive.	,,	(3) *Include* **British animals**, such as— (*a*) Fox and otter, hunted for **sport.** (*a*) Weasel and hawk, trapped or shot **at sight.** *Include* **foreign animals**, such as tigers and snakes in India, destroyed because so **dangerous.**
Stage II.—Objects of Hunting. (1) Hunting is followed— (*a*) To **supply food.**	Questioning.	(1) (*a*) *Ask* why **savage man**, who has domesticated no animals, **must of necessity** hunt?—(Food.) When we **civilised men** find our appetites **tiring of butcher's meat**, what food can we turn to?—(**Game.**) What is the great **difference** between the **hunting of savage man** and that of **civilised man?**—(The former is **compelled** to hunt, and the latter is not.)
(*b*) To **obtain clothing** or other **useful** animal **products.**		(*b*) When a **savage** has **hunted** a beast for **food**, what use does he often make of the **beast's skin?**—(Clothing or tent shelter.)

HUNTING—*Continued*

Objects and Apparatus.—Pictures of Furred and Feathered Game (British), and of Noxious Animals hunted to Destruction; also as many Specimens as possible of the Animal Products of Commerce obtained by Hunting.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		For instance, **how do Esquimaux use** up whale **fat?**—(A beverage and a lamp oil.) Or walrus **ivory?**—(Tools and weapons.) Name some of the animal products we **civilised beings** obtain **only by** hunting?
(*c*) To **destroy noxious animals.**	Questioning.	(*c*) **Why** do we **hunt foxes,** or otters, or tigers, **trap weasels** and **shoot hawks, none** of whose bodies yield flesh **fit for food?**—(To be **rid of them.**) If **let alone** and allowed to live near men, what **would** these animals **destroy?**—(The **property** and even the **lives** of men.)
(2) Among— (*a*) **Uncivilised men** hunting is the **chief employment.**	,,	(2) (*a*) *Ask* why **savage** man is compelled to get **all his flesh food** by hunting?—(Because he has **not domesticated any animals** he can kill without hunting.) As man wants **meals every day** will **hunting occupy** little or **much** of the **time** of savages?—(Much.) As **civilised man** has **not this necessity** to spend all his time in hunting for his meals, what **better use** can he make **of his time?**—(Pursuit of the **arts** and **manufactures.**)
(*b*) **Civilised men** hunting is only indulged in as a **recreation.**		(*b*) *Ask* who **indulge** in hunting among us, the **rich** or the **poor?**—(The rich.) Are they compelled to hunt, or do **they hunt for the pleasure** of it?—(Pleasure.)
STAGE III.—Methods of Hunting. (1) By **fire-arms** and other weapons.	Questioning.	(1) *Ask* if **wild creatures** come to us or **fly from us,** as a rule?—(Fly.) What **kind of a weapon** is best to attack them, one which must be used **at close quarters,** or one which can **deal death at a distance?**—(At a distance.) Name some **pro-**

		jectile weapons, or weapons which can be thrown a distance.—(Arrows, javelins, slings, fire-arms.) **Why** are guns **called fire-arms?**—(Because they are arms used by the aid of fire.)
(2) By **stratagems**, such as nets, traps, and pitfalls.	,,	(2) *Question on* the **methods** of using **nets, traps,** and **pitfalls**, and the nature of them. *Ask*, if a creature is **caught** in one of them, does it **die immediately** or a **lingering** death?—(Lingering.) Will this death be a **quick and merciful** one, or a **slow and painful one?**—(Slow and painful.) Why is it **not right** to use such contrivances when the **creature may be** caught and **killed more quickly?**—(Because it is **cruel** and **unnecessary** torture.)
(3) By dogs, falcons, and other **trained animals.**	,,	(3) Is **man** generally more or **less fleet** than the **animals?**—(Less.) Name **some fleet animals** which man has **trained** to assist him in hunting?—(**Dogs.**) But dogs **cannot pursue** birds **in the air**, so what did man train for this purpose **before gunpowder,** which reaches such a long distance, **was invented?**—(Falcons and **Hawks.**)
STAGE IV.—Hunting in England. (1) **Fox-hunting** is followed as a **recreation** in England.	Telling.	(1) *Describe* how the fox is "**preserved**" by the wealthy; that is, although a **noxious animal**, they do not like any one to kill a fox as **vermin**, but would rather **pay the farmers** for the poultry it steals, and **reserve** the fox **for hunting.** *Describe* the **excitement of men and hounds**, the cleverness of the **horses**, the **fresh air** and **healthy exercise** obtained by hunting. *Apply the test* for cruelty—if **no unnecessary pain** has been given the **quarry**, and if a death in a **trap** would be **more lingering** and painful, then the **balance is in favour of hunting** with strong **dogs** whose **powerful jaws** kill quickly, and not till the **fox** has had a **fair chance** of escaping by his own **cleverness and speed.**
(2) **Otters** are sometimes hunted with **otter hounds.**	,,	(2) *State* that **otters** are **scarce**, but where they **destroy valuable fisheries** of salmon and trout they are occasionally hunted with dogs.

HUNTING—*Continued*

Objects and Apparatus.—Pictures of Furred and Feathered Game (British), and of Noxious Animals hunted to Destruction; also as many Specimens as possible of the Animal Products of Commerce obtained by Hunting.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) **Hares** are sometimes coursed with **greyhounds.**	Telling.	(3) *Define* **coursing** as "hunting in the open, where the running is fast." Note (i.) the **trial of speed** between hare and hound; and (ii.) the powerful **leverage of greyhound's jaw,** together with the instinctive **bite in the proper place,** ensures a **quick death** for the quarry. *Condemn* the coursing of **weak rabbits** in confined grounds.
(4) **Stag-hunting** is **dying out** in England.	,,	(4) *Account for* the decay of this once "**royal sport**" by the **decrease of really wild stags.** (Red deer only on Dartmoor.)
(5) **Fishing,** and the **shooting** of game birds, are of the nature of hunting.	,,	(5) *Mention* these methods of **capturing food supplies.** [See Lessons on "Feathered Game."]
STAGE V.—Recapitulation and Additional Information. Hunting is right and proper when undertaken— (1) To supply some food or useful product which **cannot be obtained otherwise.** (2) To rid a place of noxious animals if they **cannot be exterminated in a better way.** (3) To supply healthy sport, if the quarry is **not put to any unnecessary pain.**	Questioning and Telling.	After usual recapitulatory review, add— *Make all the points* in the **three provisos** of (1), (2), and (3). *Claim* for hunting that when **properly pursued,** viz., with personal **exertion,** with an element of **danger,** and **fairness to the quarry,** that it is a **manly pursuit**; if with **cruelty** and callousness, it is the **opposite.**

See Lesson on "Feathered Game."

XVI.—THE WEASEL TRIBE

Objects and Apparatus.—Wall-pictures of Weasel, Polecat, Stoat, Marten, Otter (all to same scale); a Live Ferret in a Wire Cage; some Fur of Ermine, Otter, and Marten.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictures (or Stuffed Specimens).	
(1) In **England** is found a group of **wild animals**, small beasts of prey, all having long **snake-like bodies** and **short legs.**	By Observation and Experiment. (1) *Point out*, and *name*, the animals on the pictures; *note* **form of body** and **smallness of legs.** *Exhibit* **ferret**, and *tell* that this is of same tribe, but **not** found **wild in England**; it is kept for **hunting purposes.**
(2) The **weasel** is the **smallest**, but most familiar, of his kind; it is brown with white underparts.	(2) *Draw attention* to **small head, neck** as **thick** as the body, and the **snake-like curve** of the whole form.
(3) The **stoat** has a coat of reddish-brown fur in **summer**, but in **winter** it turns to a creamy white, except the extreme tip of the tail, and is then called the **ermine.**	(3) *Show* picture in **both coats.** *Compare* **black** tail **tips** in both. *Pass round* specimen of **ermine fur** (white, with black tail tips). *Note* that the stoat **scarcely turns white** in **England**; the change is more decided in colder countries.
(4) The **polecat** is more than **twice the size** of the weasel; it is blackish brown, paler on the sides, with white spots on the head.	(4) *Estimate* the **various lengths** by holding two hands apart, namely, about six inches for the weasel, nine inches for the stoat, and eighteen inches for the polecat.
(5) The **marten** has a white patch on the throat and **a longer tail.**	(5) *Contrast* with very **thin tails** of the others. *Admit* marten to be most pleasing of this tribe.
(6) The **otter** is large and strong, with webbed **feet for swimming.**	(6) *Point out* **these features**, and *announce* a separate Lesson for the otter.
STAGE II.—The Weasel Tribe (in common).	
(1) **All** these small beasts of prey—	By Questioning, Telling, and Comparison. (1) *Say* that we shall observe certain **features** and **habits common** to this tribe—
(*a*) Have long, lithe, **snake-like bodies**, to enable them **to pass through narrow holes** and crevices in search of their prey.	(*a*) *Contrast* **dog tribe**, which combine in **packs** and hunt by **fleetness** of foot. *Contrast* **cat tribe**, which hunt **stealthily** like weasels, but have **greater size and weight.** *Discover* that they will **hunt smaller prey**, therefore need to get through small spaces, and hence slender **form.**

THE WEASEL TRIBE—*continued*

Objects and Apparatus.—Wall-pictures of Weasel, Polecat, Stoat, Marten, Otter (all to same scale); a Live Ferret in a Wire Cage; some Fur of Ermine, Otter, and Marten.

MATTER SUMMARISED.

(*b*) Have sharp **curved claws** (five toes on each foot) to help them **climb trees** and pass along the branches.

(*c*) Although **small**, they have **great courage** and strength.

A Marten.

(*d*) Are **dainty feeders**, generally eating **the brain** and sucking the **blood** of their victims, leaving the rest.

(*e*) Have **teeth sharp** and strong to **kill** by a **single bite**, and also teeth for **grinding food** before swallowing.

(2) Like almost all flesh-eating animals they seek their **prey** chiefly **by night**, and have **whiskers** to act as **feelers**.

DETAILED HINTS AND SUGGESTIONS.

(*b*) *Elicit* that this **climbing power** gives them **access** to squirrels, **birds**, and eggs, as easily as their **lithe form** gives access to **burrows**.

(*c*) *Note* that they **hunt by scent**, are relentless in pursuit, and very destructive.

A Weasel.

(*d*) *Describe* **method of attack**—a weasel creeps near, springs, alights on the head of the victim, holds tightly with paws, and drives its long teeth through the **spinal cord**.

(*e*) *Point out* **canine teeth** of a child, corresponding to these long **tearing teeth**.

Contrast with cat and dog tribes, which do **not grind their food**.

(2) *Question* on the **nocturnal hunters** known.

STAGE III.—Individual Characteristics.

(1) The **weasel**—

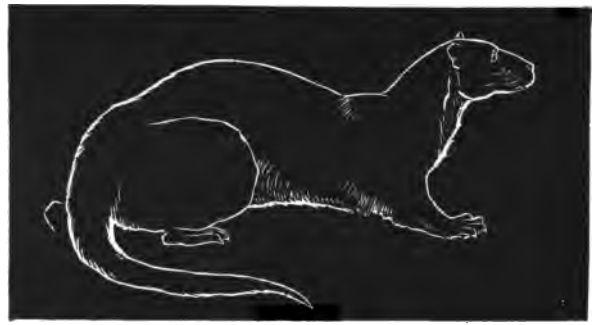
(*a*) Is a **foe to the gamekeeper,** as he destroys eggs and young of pheasants and partridges.

(*b*) Is a **friend to farmers** by his untiring slaughter of rats and mice.

By Questioning, Telling, and Comparison.

(1) (*a*) *Question* on **game preserving.**
Tell that the weasel cleverly **pierces the egg shell and sucks** through the puncture.

(*b*) *Contrast* the **two aspects** of the weasel—the gamekeeper shoots him as **wood vermin,** and yet he preys on **farm vermin.**



An Otter.

(2) The **stoat**—

(*a*) Is a ferocious little creature frequenting **barns and outhouses** in pursuit of rats and mice; it is also **destructive of eggs, poultry,** and young rabbits.

(*b*) **In countries** which are **snow-bound** in winter its coat changes to white, and it is then **called the ermine.**

(2) (*a*) *Elicit* **facility of pursuit** under floors and rafters, or into burrows (thin body).

(*b*) *Obtain* names of **cold countries** (Russia, Canada), and then discover where ermine **furs are obtained.**
Question on the **twofold advantages** of white, namely, (i.) **protects** from observation against snow; and (ii.) **keeps in the heat** of the body better than dark colours.

THE WEASEL TRIBE—*continued*

Objects and Apparatus.—Wall-pictures of Weasel, Polecat, Stoat, Marten, Otter (all to same scale); a Live Ferret in a Wire Cage; some Fur of Ermine, Otter, and Marten.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(3) The **polecat**—	
(*a*) Is **the most destructive animal,** preying on hares and rabbits, poultry large and small.	(3) (*a*) *Differentiate* **wild prey** (game) and **tame** (poultry); and *show* that the polecat is the **enemy of both gamekeeper and farmer.** *Describe* destructiveness—in one night it will kill as many as thirty birds, fowl, geese, and turkeys, whose bloodless bodies are found in the pen next day.
(*b*) It also eats rats, mice, frogs, toads, and can **even catch eels.**	(*b*) *Show* that **no creature is safe** from its attack.
(*c*) And when wounded or annoyed it **emits a very unpleasant scent.**	(*c*) *Explain* that the evil odour **proceeds from a gland** near the base of the tail, and is strong and lasting—an article touched by the animal **cannot be cleansed** of it **for days.**
(4) The **marten** is found only in Derbyshire. The **ferret** came from Africa.	(4) *Note* that marten **furs are imported** from Canada; that the **ferret** has to be **kept warm** in its cage; and that it is used to **drive rabbits out** of their burrows when the keeper wants to shoot them.
STAGE IV.—Additional Information.	RECAPITULATORY.
	By recapitulatory questioning *gather up* the main points, and correlate them; then *may be added*—
(1) All these animals are **characterised** by their **sharpness and activity.**	(1) *Mention* that the name of an old song was "Pop goes the Weasel"—**popping** describes its **quickness.**
(2) All have **fur** composed of **two sorts of hair,** the under hair and the long overhair.	(2) In naming the **furs** yielded by this **same tribe** *may be mentioned* the **sable** (Siberia), **mink** (America), and the **skunk** (America), which last named emits a vile odour like the polecat.
(3) All of them are **called vermin,** because they are **so destructive.**	(3) *Tell* how **gamekeepers** kill these creatures, and **nail them to trees** in the woods, as a kind of "caution" to other depredators. *Suggest* that the emitted odour of some of these creatures is really a kind of defence against enemies—it is so offensive to the nose.

XVII.—OTTER

Objects and Apparatus.—Picture of Otter; Specimen of Otter Fur; a Cat.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture.	
(1) The otter has a **general resemblance** to other members of **weasel tribe**—	By Observation.
(*a*) Long lithe **body.**	(1) *Compare* for **colour, shape,** and **size** (a larger member of the tribe). *Indicate* length of animal by holding hands two feet apart.
(*b*) Small **head** and **ears.**	
(*c*) Two kinds of **hair** in fur (brown).	
(2) It **differs** from them in—	(2) From likenesses *proceed to note* **differences.**
(*a*) The broad and webbed **feet** (five toes on each foot).	(*a*) *Compare* with **feet** of ducks and **geese.**
(*b*) The broad, flat, tapering **tail.**	(*b*) *Contrast* with thin **stringy-looking tails** of weasel and stoat.
(3) It has **large eyes** and strong **whiskers.**	(3) *Point out* these **features**—indicative of a **night hunter.**
STAGE II.—The Otter: its Structure and Habits.	
(1) The otter leads almost a **double life,** on **land** and in **water**; making its home in some **hole** on the **banks of a stream.**	By Questioning, Telling, and Comparison.
	(1) *Question* on **formation** for swimming and diving (can hold its breath under water a long time.) *Compare* with **frog,** a true amphibian, and contrast their **breathing organs.** (See Lesson on Frog.)
(2) The otter—	
(*a*) Has sharp **teeth.**	(2) (*a*) *Compare* with **other flesh-eaters,** and particularly with **long teeth** of others of **weasel tribe.**
(*b*) **Lives** entirely upon **fish.**	(*b*) *Contrast* with others of the tribe which **prey upon small quadrupeds** and birds.
(*c*) Is a **dainty feeder.**	(*c*) *Compare* with other weasels, which are all equally destructive. *Tell* that an otter **captures a fish, pins it** with its long sharp teeth, and then **eats a few flakes** of the thick flesh at the back of the neck, **leaving the bulk** of the fish to **waste.**
(3) It is **formed** to—	(3) (*a*) *Question* on **webbed feet** and **lithe body**; *say* that in water it **resembles the seal,** particularly in the way it uses its hind feet in swimming.
(*a*) **Swim** with ease and grace (pliant body with short legs).	

OTTER—*Continued*

Objects and Apparatus.—Picture of Otter; Specimen of Otter Fur; a Cat.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE IV.—Additional Information.	By Recapitulatory Questioning.
	Bring out leading points of each stage, and *correlate* the various *facts*. It may *then be added*—
(1) There are **sea-otters** (shores of North Pacific).	(1) *Note* that in **Scotland** the otters there will fish **out at sea** some distance.
(2) The **fur** of the otter is valued and exported from Canada and Siberia.	(2) The otter **fur of commerce** is chiefly that of the sea-otter.
(3) The **word otter** means "the water animal."	
(4) Otters have been **trained** by fishermen **to drive fish** towards their net.	

XVIII.—BADGER

Objects and Apparatus.—Pictures of Badger and Bear.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture.	By Observation.
(1) The **badger** is an animal the **size** of a medium **dog.**	(1) *Note* that it **stands** much **lower** than a dog with same size of body; *indicate* **length** by holding hands two and a quarter feet apart.
(2) Its **head** is long and pointed, the **jaws** being very powerful.	(2) *Note* the **leverage** of the jaws for biting power, and strength of the **under jaw.**
(3) The **hair** is long, concealing the **ears**; and the **tail** is short.	(3) *Note* that the **hair** almost **trails**; and that the **tail** reaches down to below middle of the **short legs**; that **ears** and **eyes** are **small.**

(4) The **colour** is sandy-grey; the **face** is white, marked on each side by a **band of black**, which runs in the line of the eye and ear.

(4) *Note* that the **hair** is yellow at roots and at tips, but bluish-brown in middle: the **whole effect is a rusty-grey.**

A Badger's Leg and Claws.

The Badger.

(5) The **legs** are short, and the **claws** are strong; the animal **walks on the whole sole**, and not on toe tips.

(5) *Call attention* to **digging** power of **claws**, combined with **muscular** chest.
Particularise the **sole-walking**, *contrasting* with the many **toe-walking** animals.
Compare with **bear's foot.**

Objects and Apparatus.—Pictures of Badger and Bear.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE II.—The Badger: Structure and Habits.	By Questioning, Telling, and Comparison.
(1) The badger is one of the **few sole-walking animals**; and is found in **England**, though now **scarce.**	(1) *Question* on formation of feet (**plantigrades** and **digitigrades**). *Compare* with **bear**; and also in **length of body** and **shortness of legs** with weasel tribe. *Give* the old English name "**brock**" to it, as an alternative.
(2) It is a **flesh eater** and a **vegetable eater.**	(2) *Question* on **teeth formation** of various animals (carnivorous and herbivorous). *Tell* that the badger has **teeth** for tearing and for grinding, and can therefore eat **both kinds of food**; it lives chiefly on eggs, birds, snails, fruits, and roots; and (like the bear) is **fond of the honey** of wild bees, and can scent it out wherever bees exist.
(3) The badger digs out a **burrow**, which has **one** external **opening**, but several **interior chambers**, and there leads a **solitary life.**	(3) *Elicit* use of strong **claws** (digging **burrow**, and obtaining **roots** to eat). *Ask why* an **earth-dweller** requires **eyes** and **ears** to be small.
(4) **A circular den** at the end of the burrow is **lined** with leaves and grass, and there the badger **sleeps away the day.**	(4) *Compare* with burrows of **fox** and **rabbit**; badger prefers light sandy soil. *Elicit* that with so much sleep after good meals it must **get fat.** *Lead up to* its hibernation, the **stored-up fat** serving it during its **winter sleep.**
(5) The badger moves **out at night** in search of **food**, and then only in the **depths** of **the wood.**	(5) *Describe* the animal as very **retiring**. *Reason out* its scarcity in **crowded England.**
(6) Not only is the **hair thick**, but the **skin is loose** and exceedingly **tough.**	(6) *Elicit* how (in other countries) the badger can **brave the stings** of the wild bees when robbing them of their honey.
(7) Though **harmless**, when attacked the badger shows great courage and resolution, and can **grapple** with a **dog twice its own weight.**	(7) *Elicit* its **formidable** nature (short **legs** on muscular **body**, armed with sharp, strong **claws**, aided by powerful **jaws** with sharp, strong **teeth**).

STAGE III.—Badger-baiting.

(1) In **olden times,** when Englishmen were cruel to dumb animals, badgers were **baited** by dogs for "**sport.**"

(2) A **strong** and courageous **badger** was caught, placed inside a **kennel**, and dogs set at it, **to seize** it and **draw it** out.

(3) The **dogs** were frequently **mangled** by the badger, and only their **numbers** could give them the **advantage** in the end.

(4) Not only has the badger very powerful jaws, but the **underjaw** is so formed that when it closes the teeth **almost interlock.**

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STAGE IV.—Additional Information.

(1) The badger is a **harmless** animal, and therefore there is **no** particular **need to destroy** it as **vermin.**

(2) When it is **dug out** of its burrow, it **retreats** from one chamber to another.

(3) As men could **not hunt** it, in olden days they **used to train their dogs** upon it, in courage for attack.

(4) The **hair** is used in the manufacture of **brushes.**

By Questioning, Telling, and Comparison.

(1) *Describe* "**baiting**" as setting on dogs to bite and worry.
Rejoice that we know the **duty of kindness** nowadays.
Condemn any "sport" which gives **needless pain** to a creature.

(2) *Name* the success of a bold dog in this operation, as "**drawing the badger.**"
Bring out the security of such a **retreat,** and the **difficulties** encountered by the **dogs.**
Praise the **courage of the dog,** but *condemn* the **cruel man** imposing such a test of it.

(3) *Enumerate* all the animal's natural **weapons of defence.**
Add that sometimes when a good **dog had pinned** the badger through its **leathery skin,** its **looseness permitted** the creature **to turn** round and **bite the dog.**

(4) *Bring out* these points—(*a*) **jaw** leverage, (*b*) sharp **teeth,** (*c*) a **locked bite.**
Account thus for the **destruction** of so many of the **attacking dogs.**
Say that this **deadly bite** the badger performed with very **little exertion.**
Derive the word "**badgering**" from this worrying of the poor badger.

By Questioning and Telling.

After recapitulatory questioning to bring out main points in each stage, the following matter *may be added*—

(1) *Explain* that its greatest **depredation** may consist of taking an occasional young **rabbit,** or a few pheasant and partridge **eggs.**

(2) *Compare* the various retreats to the **earthworks** behind which soldiers fight and retreat.

(3) *Show* that the badger **never** came out **into the open,** and that even dogs could **not drive him out** as they do the fox.

(4) *Exhibit* some, and show they are **coarser** than camel hair brushes.

XIX.—BAT

Objects and Apparatus.—Picture of Bats (or Stuffed Specimens), various ; an Umbrella.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of the Picture (or Specimen).	BY OBSERVATION.
(1) The bat is a small creature, **like a mouse** with large **wings.**	(1) *Use* alternative name "**flittermouse,**" as descriptive of the creature.
(2) The wings—	
(*a*) **Expand** to five or six times the length of the body.	(2) (*a*) *Call attention* to excessive **size of wings**, as compared with (fur-clad) body.
(*b*) Are **leathery** skins, with **bony framework** like umbrella ribs.	(*b*) *Examine* leathery or **parchment nature** of wings.
(*c*) **Join together** the fore and hind **limbs**, and the two wings join at the **tail.**	(*c*) *Point out* (i.) that the fore limb is like a **winged hand** (skin joining the fingers, as **webbed toes** are joined), the **fingers** being **very long**, and the **thumb** remaining like a **hooked nail** ; (ii.) that the **hind limb** is much **smaller**, the wing-skin only reaching to "ankle," leaving **five distinct toes** unjoined and armed **with sharp** curved **claws.**
(3) The covering of the body is fine dusky **fur**, while the ears and nose are **bare.**	(3) *Note* qualities of the hair—"**dusky**" or dark in colour, and "**fine**" or light in texture.
(4) The **ears** are very large, the **mouth** is large, and the small **eyes** are bright.	(4) *Note* that there are various kinds of bats, the **long-eared bat** being **most common** in England.
STAGE II.—Structure and Habits.	BY QUESTIONING, TELLING, AND COMPARISON.
(1) The bat is a **flying animal,** and has very **large wings.**	(1) *Ask* what is the most **striking feature.**—(Wings.) And what it **indicates.**—(A flying animal.) *Ask* what are the **creatures** which **usually fly.**—(Birds and insects.) If an "animal" is **built lighter** or heavier than these.—(Heavier.) And if it will **need large** or small **wings.**—(Large.) *Imitate* wing movements of a bird by **flapping the arms** ; then *discover* the **immense size** of wings a man's heavy body would need—and *compare* with wings of this flying mammal. *Note* that the **bat really** is **lightly constructed** : yet to correspond,

(2) The **body** is covered with **dark fur,** and the **wing membranes** are also **dark**; the bat is a **cleanly** animal, and combs its fur with its hind feet.

a man's fingers would need to be **drawn out,** like umbrella **wire, four feet.**

(2) *Discover* that the children who have **seen a live bat** flying about, saw it **in the dusk**—that it hides away in daytime—its presence **cannot readily be observed** in its dark corners. [feet.
Tell that the bat **combs its fur,** parting it down the middle, with its hind

A Bat.

(3) The bat **sleeps** during the **day, hanging up** by its hind legs in some **dark recess,** with its **wings folded** round the body.

(4) It **comes out at night** to feed on gnats and other **small insects** which fly about in the evening.

(3) *Refer* to curved **grasping toes** of hind limbs.
Suggest barn-roofs, caverns, and hollow trees as **retreats.**
Exhibit a picture of **sleeping bat suspended** by its hind claws.
Illustrate by the **furling of an umbrella** round its stick.

(4) *Compare* with the **swallow,** which flies about feeding in same way during daytime.
Question out that it will need to **fly swiftly,** and with wide **open mouth** (hence size of wings and size of mouth). [the water.
Tell that it can also **drink while on the wing,** skimming the surface of
Tell that its **flight is noiseless,** as the wings do **not rustle**—ergo, they are soft, not stiff.

BAT—*Continued*

Objects and Apparatus.—Picture of Bats (or Stuffed Specimens), various ; an Umbrella.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(5) Its **sight** is weak, but its **hearing** is very keen.	(5) *Question* on **size of ears**, and on **inutility** of keen **sight** in dusky twilight. *Note* a **pointed membrane** (the tragus), the actual ear, inside the large long ear. [touched.
(6) The bat's **sense of touch** is also extremely **keen**, even throughout its **flying membrane.**	(6) *Experiment* on a **child's sense of touch**—if blindfolded can tell where *Tell* that we **feel through** our **nerves**, that **bats** have nerves **throughout their wings**, and that they are **very sensitive** to touch—that a bat can tell when **an insect touches** its wings. *Argue* **necessity for keen senses** of hearing and feeling when sight is of little use. *Tell* how bats will **sometimes brush against a person** in the dark, how they **fly swiftly** (in pursuit of insects) **in the dark,** yet avoid dashing against branches of trees or other **obstacles** through which they easily **thread their flight.**
(7) Bats **sleep** throughout the **winter,** when **no insects** are available **for food.**	(7) *Ask* for the **season** when gnats and flies abound (summer), and what **an insect-eater** often does throughout the **cold season** (sleeps or migrates, as **frog** and **swallow**). *Mention* that bats sometimes **sleep embracing** and sheltering each other, and that they often **die** hanging thus **upside down.**
(8) The bat has a weak and **curious little cry.**	(8) *Imitate* the cry by drawing a pencil over a slate, so as to **make a feeble screech.**
STAGE III.—Additional Information.	BY QUESTIONING AND TELLING. By *recapitulatory questioning* bring out *main points* of the subject, particularly that— The bat is a **suckling** animal (mammal). ,, has a **skeleton** of bone (vertebrate). ,, is **hand-winged.** ,, is an **insect eater,** which is **nocturnal**, and **sleeps** through the **winter.**

(1) The bat serves a **useful** purpose in **clearing the air** of troublesome insects. (2) There are various **sorts** of bats— (*a*) Some are **insect feeders**. (*b*) Some are **fruit eaters.** (*c*) Some are **blood suckers.** One **British bat** has some **skin** in front of the **nostrils,** which is somewhat in the **shape of a horse-shoe.**	Then *may be added* the following matter :— (1) *Number* the bat as **one of nature's checks** (on insects). (2) *Recall* the name of one examined—**the long-eared bat.** (*a*) *Tell* that these have sharp **teeth** for cracking **insect cases,** but not for masticating. (*b*) ,, ,, **small grinders** for grinding food (**fruit bats** have **rough tongues** for boring the pulp). (*c*) ,, ,, **lancet-pointed** teeth for making **punctures** in the victim's **skin** (**vampire bat**). *Name* this the **horse-shoe bat.**

XX.—FEATHERED SONGSTERS

Objects and Apparatus.—Pictures (or Stuffed Specimens) of the Four Songsters, and, if possible, their Eggs ; a Thrush's Nest ; a Landscape Picture in which the artist is sure to have introduced Animated Life.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—*Introductory.*		
(1) The grandest **scenery fails to satisfy,** unless cheered by the presence of **animated life.**	Telling.	(1) *Word-paint* a **country walk,** alluding only to inanimate nature—the blue sky and fleecy clouds **above,** the bright verdure **beneath ;** the masses of **foliage** clothing the **giant trees,** and the brilliant **tints of bloom** and floweret meeting the eye **on every hand ;** the whole landscape **pervaded** by a fresh **atmosphere** sweetened by the **breath of flowers,** and illumined by a **flood of sunshine.** *Then proceed to describe* a **solemn stillness** over the whole of this pleasant scene, and an **unaccountable feeling** that **something is lacking** to make it really pleasant and satisfying to the mind.

Objects and Apparatus.—Picture of Bats (or Stuffed Specimens), various ; an Umbrella.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(5) Its **sight** is weak, but its **hearing** is very keen.	(5) *Question* on **size of ears**, and on **inutility** of keen **sight** in dusky twilight. *Note* a **pointed membrane** (the tragus), the actual ear, inside the large long ear. [touched.
(6) The bat's **sense of touch** is also extremely **keen**, even throughout its **flying membrane.**	(6) *Experiment* on a **child's sense of touch**—if blindfolded can tell where *Tell* that we **feel through** our **nerves**, that **bats** have nerves **throughout their wings**, and that they are **very sensitive** to touch—that a bat can tell when **an insect touches** its wings. *Argue* **necessity for keen senses** of hearing and feeling when sight is of little use. *Tell* how bats will **sometimes brush against a person** in the dark, how they **fly swiftly** (in pursuit of insects) **in the dark,** yet avoid dashing against branches of trees or other **obstacles** through which they easily **thread their flight.**
(7) Bats **sleep** throughout the **winter,** when **no insects** are available **for food.**	(7) *Ask* for the **season** when gnats and flies abound (summer), and what **an insect-eater** often does throughout the **cold season** (sleeps or migrates, as **frog** and **swallow**). *Mention* that bats sometimes **sleep embracing** and sheltering each other, and that they often **die** hanging thus **upside down.**
(8) The bat has a weak and **curious little cry.**	(8) *Imitate* the cry by drawing a pencil over a slate, so as to **make a feeble screech.**

STAGE III.—Additional Information.

BY QUESTIONING AND TELLING.

By *recapitulatory questioning* bring out *main points* of the subject, particularly that—

The bat is a **suckling** animal (mammal).
,, has a **skeleton** of bone (vertebrate).
,, is **hand-winged.**
,, is an **insect eater,** which is **noctural,** and **sleeps** through the **winter.**

(1) The bat serves a **useful** purpose in **clearing the air** of troublesome insects.	Then *may be added* the following matter :— (1) *Number* the bat as **one of nature's checks** (on insects).
(2) There are various **sorts** of bats—	(2) *Recall* the name of one examined—**the long-eared bat.**
(*a*) Some are **insect feeders.**	(*a*) *Tell* that these have sharp **teeth** for cracking **insect cases,** but not for masticating.
(*b*) Some are **fruit eaters.**	(*b*) ,, ,, **small grinders** for grinding food (**fruit bats** have **rough tongues** for boring the pulp).
(*c*) Some are **blood suckers.**	(*c*) ,, ,, **lancet-pointed** teeth for making **punctures** in the victim's **skin** (**vampire bat**).
One **British bat** has some **skin** in front of the **nostrils,** which is somewhat in the **shape of a horse-shoe.**	*Name* this the **horse-shoe bat.**

XX.—FEATHERED SONGSTERS

Objects and Apparatus.—Pictures (or Stuffed Specimens) of the Four Songsters, and, if possible, their Eggs ; a Thrush's Nest ; a Landscape Picture in which the artist is sure to have introduced Animated Life.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Introductory. (1) The grandest **scenery fails to satisfy,** unless cheered by the presence of **animated life.**	Telling.	(1) *Word-paint* a **country walk,** alluding only to inanimate nature—the blue sky and fleecy clouds **above,** the bright verdure **beneath ;** the masses of **foliage** clothing the **giant trees,** and the brilliant **tints of bloom** and floweret meeting the eye **on every hand ;** the whole landscape **pervaded** by a fresh **atmosphere** sweetened by the **breath of flowers,** and illumined by a **flood of sunshine.** *Then proceed to describe* a **solemn stillness** over the whole of this pleasant scene, and an **unaccountable feeling** that **something is lacking** to make it really pleasant and satisfying to the mind.

FEATHERED SONGSTERS—*Continued*

Objects and Apparatus.—Pictures (or Stuffed Specimens) of the Four Songsters, and, if possible, their Eggs; a Thrush's Nest; a Landscape Picture in which the artist is sure to have introduced Animated Life.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		Discover that what is really **required to complete the joys of nature** are life and motion—the presence and the voices of **living creatures**—the hum and buzz of **insect life**, the lowing of **cattle**, the flitting and twittering of the **birds of the air**.
(2) Not the least **acceptable** forms of life are the **song birds**.	Questioning.	(2) *Ask* for the **names** of some of those **birds** whose **sweet songs** add to the **pleasures of life**.
STAGE II.—Four English Song Birds Examined.		
(1) **The robin**—	Observation.	(1) (*a*) *Let children identify* by the affectionate name, "robin redbreast."
(*a*) Is distinguished by **red** coloured feathers on **breast and throat**.		
(*b*) The **upper parts** of the body are **brown**, and the **under parts light**.		(*b*) *Note* how the **under parts fade** to a yellowish white, **in contrast** to dark **upper parts**.
(*c*) The **body** is **small** and well **rounded**.		(*c*) *Note* the general **outline**, having the **plumpness of a ball**.
(*d*) The **wings** are short; the **tail** is broad and points upwards.		(*d*) *Note* that **wings** are nearly **black**—*call* them "**black sleeves**."
(*e*) The **bill** is short and conical, and the **gape** furnished with a few bristles.		(*e*) *Note* the bristles **standing out** round the side of the **mouth**.
(*f*) The **toes** are of moderate length, the **claws curved** and sharp.		(*f*) *Notice* the **four toes**, three to front, and one to rear.
(2) **The skylark**—	,,	(2) (*a*) *Compared* with body of **robin**, it is **longer but more slender**.
(*a*) Is a little **larger** (or longer):		
(*b*) Has plumage a dull **grey-brown**, marked by **margins** of the **feathers** on the upper parts:		(*b*) *Note* the **curved margins** of feathers, giving a **wavy appearance** to the upper plumage; the **brown** takes the **shade of the soil** on which the bird lives (**protective**.)

(*c*) The breast being paler brown, and the **underparts** yellowish white. (*d*) The feathers of the **crown** are elongated into a **little crest.** (*e*) The **tail** is **forked** a little. (*f*) The **bill** is short and conical. (*g*) The front toes are long, and the **hind toe** very **long and straight.**		(*c*) *Note* the **under parts,** again **fading** away to **lighter hues.** (*d*) *Name* this (and the straight toes) as **distinguishing features** of the skylark. (*e*) *Contrast* with **robin's tail.** (*f*) *Compare* with **robin's.** (*g*) *State* that **all the larks** (skylarks, woodlarks, titlarks) are known by the **long hind toe.**
(3) **The thrush** or throstle— (*a*) Is **one of the largest** of English song birds. (*b*) The **upper parts** are a **dark brown.** (*c*) The throat, neck, and sides are yellowish, **beautifully speckled** with brown. (*d*) The **bill** is **brown**, and furnished with **bristles** at the gape. (*e*) The **toes** are **long and strong**, and have sharp **curved claws.**	,,	(3) (*a*) *Compare* sizes *again.* (*b*) *Note* **dull upper coat** again—like the **colour** of the **branches** they perch on (**protective**). (*c*) *Compare* this beautiful **speckled breast** with the **robin's vest of red.** (*d*) *Compare* with **bristles** at the base of robin's beak. *Describe* its **habit of smashing snail shells** on hard **stones.** (*e*) *Compare* with robin's—contrast with skylark's toes.
(4) The **nightingale**— (*a*) Is about the **size** of the **skylark.** (*b*) The **upper parts** are **brownish-grey.** (*c*) The throat and chest are **whitish, merging** outwards into **grey.** (*d*) The **bill** is long, slender, and straight. (*e*) The **legs** are long and slender; the **claws** are sharp and **curved.**	,,	(4) (*a*) *Compare* for **size—less than** the **skylark,** but not so small as the robin. (*b*) *Note* **same** general **arrangement**—the **upper parts dark** and— (*c*) The **lower parts lighter** in colour. (*d*) *Note* **slender bill.** (*e*) *Note* **slender legs.**
STAGE III.—Compared and Contrasted as a Whole.		
(1) They are **all** four classed as **perching birds** (having three toes directed forward, and one backward) because they perch or sit, even asleep, **living entirely in trees.**	Telling.	(1) *Compare* **hind toe** to our **thumb** as used in **grasping.** *Remind* how they **swing** in the **breeze** on some **high branch.** *Except* (outside classification) the skylark, which is **not actually a percher,** as its **toes** are quite **straight** for **walking.**

FEATHERED SONGSTERS—*Continued*

Objects and Apparatus.—Pictures (or Stuffed Specimens) of the Four Songsters, and, if possible, their Eggs; a Thrush's Nest; a Landscape Picture in which the artist is sure to have introduced Animated Life.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) They **cannot walk**, but only **hop**.	Telling.	(2) *Describe* **exceptional gait** of skylark, which **runs** along the ground **very fast, ducking** its head here and there, and seeming **always in a hurry**.
(3) They **feed** partly on **grain**, partly on **fruit**, and partly on **grubs and insects**.	,,	(3) *Locate* **feeding grounds**; as grain from **fields**, fruit from **gardens**, and prey from **soft earth**.
(4) All their **young** are **hatched naked**; so they **weave substantial nests** with beak and claw, and **smooth** and round the **insides** of them for their **tender nestlings**.	,,	(4) *Exhibit* a **thrush's nest as typical**—it is large, round, and cup-shaped, made of roots and mosses with a thin layer of cow-dung kneaded firmly with decayèd wood; *tell* it will hold water.
(5) The **eggs** are coloured or speckled, and much larger at one end.		(5) *Instance* (i.) yellow-grey mottled with brown (**robin**); (ii.) dirty-white blotched with brown (**skylark**); (iii.) beautiful blue speckled with black (**thrush**); (iv.) dark olive-green blotched with brown (**nightingale**).
(6) **Three** of them are **tooth-billed**, having a small tooth-like **notch** near the end of the **upper beak**, which is **slightly hooked** downwards.	Observation.	(6) *Except* the **skylark**, which is **cone-billed**, and has **no notch** in the upper bill.
STAGE IV.—Individual Characteristics.		
(1) The **robin**—	Telling.	
(*a*) Has **distinctive colouring**.		(1) (*a*) *Question* on **colouring**. *Offer* for memorising, the catchy description of "**a brown coat with black sleeves, over a red vest.**"
(*b*) Has **small size** and **compact form**.		(*b*) *Question* on **relative size**. *Demonstrate* that a **child could hold a robin** in its little hand.
(*c*) **Sings** a **soft**, sweet **song**, and throughout the **winter**.		(*c*) *Explain* that robin is **solitary**, and never flocks; **seldom seen in summer**, as it hides while **rearing young**.

(2) The **skylark**—

(*a*) Has **distinctive** features in its **straight toes** and **rough crest.**

(*b*) **Never perches**; it makes its **nest on the ground.**

A Robin.

(*c*) Is the **only** English **bird** that **sings as it flies.**

(*d*) **Collects** in flocks in **autumn,** to seek **sheltered winter quarters.**

(2) (*a*) *Question* for these **two** distinctive **features,** and the **peculiarity of habit** arising from foot formation.

(*b*) *Connect* **these two facts** with the **foregoing** (*a*).

A Thrush.

(*c*) *Quote* the **poets** made **eloquent** by the skylark's **singing as it soars.**

(*d*) *Name* turnip fields, fallow fields, and wheatlands as **shelters**; in **spring** they again separate into **pairs.**

FEATHERED SONGSTERS—*Continued*

Objects and Apparatus.—Pictures (or Stuffed Specimens) of the Four Songsters, and, if possible, their Eggs; a Thrush's Nest; a Landscape Picture in which the artist is sure to have introduced Animated Life.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) The **thrush**— (*a*) Is **distinguished** by its **size** and speckled **breast.** (*b*) Is **distinguished** also for its **piercing notes**; it sings from earliest approach of spring till late in summer.	Telling.	(3) (*a*) *Question out* the **size and appearance.** *Name* the **missel thrush** as larger, and a **winter songster.** (*b*) *Tell* that it **sings from a lofty branch,** as if **to soften** its music by distance. *Contrast* with the mellow-throated **blackbird,** which **sings** from the **lowest branches.**
(4) The **nightingale**— (*a*) Is **distinguished** for its **night singing.** (*b*) It is an **insect eater,** and necessarily a **migrant.**	,,	(4) (*a*) *Teach* **appropriateness** of its name (derived from S. *galan* = "to sing")—it sings in **daytime as well.** *Describe* its **moonlight concerts** in some **grove,** often near a house, for it is **not too shy** and retiring. (*b*) *Give* its residence **in England** from **May** to about **September.**
STAGE V.—Recapitulation.		*Plead* for **protection from extermination** of all feathered songsters, whose Power of flight Beauty of plumage Melody of voice } Are a **source of pleasure, reclaiming** the landscape **from** the **desolation** always felt in the absence of life.

XXI.—BEAKS OF BIRDS

Objects and Apparatus.—Pictures of Birds dealt with, and as many Prepared Beaks as possible (certainly those of Fowl and Duck); a Fowl's Gizzard.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of some Beaks.		
(1) A **fowl's** beak is hard, **short**, and **pointed.**	Observation.	(1) *Feel* that it is **horny.**
(*a*) There are **no teeth.**		(*a*) Make this *observation* of the **inside of all the available specimens.**
(*b*) It has scale-covered lateral **nos-trils.**		(*b*) *Compare* with **our nostrils.**
(2) A **duck's** bill is **longer, softer, broader,** and **rounded** at the end.	,,	(2) *Have pointed out* separately **each difference,** as they are **seen and felt.**
(*a*) There is a **comb-like fringe** along the edges of both jaws which **fit into each other** when the bill is closed.		(*a*) *Feel* the **fringed edge.** *Open and close* the two jaws to **show how they fit,** the one over the other—**some fifty ridges** which must **not** be mistaken for **teeth.**
(*b*) The **tongue** also fits in.		(*b*) *Show* how the **tongue also fits** in.
(3) A **sparrow's** bill is **conical** and **strong.** **[powerful.**	,,	(3) *Note* that **strength is gained** by the beak being **so short.**
(4) A **parrot's** beak is **hooked** and very	,,	(4) *Note* the **extra hardness** of its horny nature.
(*a*) The **lower** jaw (mandible) is **short,** strong, and **sharp at the edge.**		(*a*) *Feel* the **cutting edges**
(*b*) The **upper** is much longer, and **curves over** the other to a **point.**		(*b*) *Feel* the **hooked point** } *or*, with live specimen *experiment* by giving a **nut to eat.**
(5) A **goatsucker's** beak **opens to** an actual **gape.**	,,	(5) *Suggest* that birds with beaks like this **may be called "gaping birds."**
(*a*) The **slit opening** runs **beyond** the **eyes.**		(*a*) *Note* also the **extreme width,** and *contrast* with narrow hard opening of sparrow's.

A Duck's Bill.

A Parrot's Beak.

A Sparrow's Beak.

BEAKS OF BIRDS—*Continued*

Objects and Apparatus.—Pictures of Birds dealt with, and as many Prepared Beaks as possible (certainly those of Fowl and Duck); a Fowl's Gizzard.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*b*) Along the **edge** of the **upper** beak on either side, there is **a row of bristles,** turned downwards.		(*b*) *Suggest* resemblance of these **bristles** to a **fence round** a field for **keeping in** the cattle.
(6) A heron's beak is very **long, strong,** and **sharply pointed.**	Observation.	(6) *Suggest* resemblance to a **dagger** made of two very fine **scissor blades.**
(7) Birds of prey (eagle, hawk, owl) have **strong hooked beaks** for **tearing flesh.**	,,	(7) *Take any examples* which can be *best illustrated* and *examined.*
Of other **small birds, some** have a **notch** in the upper beak (as robin, thrush, blackbird, nightingale) for **holding wriggling prey,** and **some** have long **slender bills** (as the wren and the American humming-bird) for **pushing into tiny crevices** in search of food.		*Show generally* that— (1) Birds having **no hands** or paws, use the **bill to catch and carry.** (2) Birds have **neck and bill long** enough **to reach** to any part of their **own bodies.** Eagle's Beak.
STAGE II.—Why Beaks Vary. (1) Beaks vary in shape, size, and build, **according** to the **nature of the bird's food.**	Questioning.	(1) *Ask* for these **differences** of (i.) shape, (ii.) size, and (iii.) texture. *Discover* that beaks are **hard horny mouths** without teeth. *Contrast* with **soft lips** enclosing **hard teeth.**
(2) Some beaks are— (*a*) **Peckers**—for picking up grain and scraps (fowl).	,,	(2) *Exhibit again,* **in order** as required, the respective **beaks dealt with.** (*a*) *Ask* **why** a fowl **scratches** up the **dirt?**—(To **find grains** and insects.) **Why** the **beak** is so **pointed?**—(To **pick up small grains** and scraps.) *Elicit* that **in drinking** fowls **hold up the beak** to allow water to run down the throat.

(*b*) **Strainers** — for draining away muddy water, and leaving morsels of food (duck, goose).	,,
(*c*) **Seed-crackers** (sparrows, crows, starlings, finches).	Telling.
(*d*) **Nut-crackers** (parrot).	Questioning.
(*e*) **Fly-traps** (goatsucker, swallows).	

The Goatsucker.

(*b*) *Experiment* with a **tooth-comb** used as a **strainer.** *Compare* with a **duck's bill.**

Ask **why** duck's bill is **longer?**—(for **groping**); and **flat and broad?**—(for **shovelling**); and **softer?**—(because used in **soft mud**).

(*c*) *Exhibit* a **cone.** *Compare* with "**cone-bills**"—strong and short for **cracking seed-cases.**

Observe that many of these cone-billed perchers **also eat soft food,** as worms and fruit.

Differentiate the **tooth-billed perchers** (warblers, thrushes), which have a **notch in the slightly curved** upper **bill,** which aids in **holding wriggling prey,** such as worms and insects.

(*d*) *Ask* what **kind of very hard seeds** parrots eat?—(**Nuts.**) What **kind of jaws** are needed **to crack** nuts?—(**Short and strong.**) And to **get out the kernels?**—(Hooked and **pointed.**) **What else** do parrots **use** their hooked **beaks to assist** them in?—(**Climbing.**)

(*e*) **Why** are goatsuckers **flying about all the evening,** and **swallows** all the live-long **day?**—(To catch **insects on the wing.**) **What** do we put **on fly-papers?**—(Something **sticky.**) **What** will **make** their gaping **mouth more deadly** fly-traps?—(**Sticky substance**—which they have.) And **what else** have they **round their mouths,** to aid in holding the flies they catch?—(**Bristles.**) What **kind of moths** and insects will the goatsucker, or **night-jar,**

Bill of the Common Heron.

Objects and Apparatus.—Pictures of Birds dealt with, and as many Prepared Beaks as possible (certainly those of Fowl and Duck); a Fowl's Gizzard.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		catch if it **comes out** only at **night-time?**—(Moths, gnats, and other **night-flying insects.**)
(*f*) **Tongs** (heron, snipe, woodcock).	Questioning.	(*f*) If a bird **lives on fish** and frogs, and yet **cannot swim**, what **kind of legs** will it need for wading?—(Tall and stilt-like.) If the bird's **legs are long**, what else **must be long** to reach down?—(**Neck and bill.**) **To catch fish** in this way, will it be **better to splash about** or to stand **quite still** in the **water?**—(Still.)
	Telling.	*Tell* how **heron** stands **patient** and **motionless** when fishing; how it **can dive from the air** and **stab** a fish through the **eye**; how it can even **impale a pursuing falcon** on its spear-like bill. *Tell* that it **feeds on newts, eels,** and toads as well; that **snipe** and **woodcock** frequent **marshes** and **flooded meadows** to fetch up **worms** from the **mud** with their **long slender bills.**
STAGE III.—Recapitulation and Additional Information. The **classification** of birds is **aided** by the forms of their **beaks** (and feet); as thus—		After *recapitulatory questioning* for main points, it *may be added*— *Compare* with **beasts** put into **flesh-eating** or **grass-eating** classes.
(1) Birds of prey—with hooked beaks (and claws).		(1) *Instance* eagle, falcon, kite. *Name* these the "seizers."
(2) Cloven-jawed birds.		(2) ,, night-jar, swallows, swifts, and martins.
(3) Slender-billed birds.		(3) ,, humming-bird.
(4) Tooth-billed birds.		(4) ,, thrushes.
(5) Cone-billed birds.		(5) ,, starlings.

(6) Climbing birds. (7) Runners. (8) Stilt-legged and long-toed. (9) Web-footed.	In which the "feet-forms" decide the appellation. (See the next Lesson.)	(6) ,, parrot, **woodpecker** (whose beak **digs insects out** of bark), **cuckoo** (which can **devour hairy caterpillars**). (7) ,, ostrich. (8) ,, heron, stork. (9) ,, duck, goose, swan. Besides these there is the **poultry tribe**, having **weaker bills**, but a strong muscular **gizzard** to assist **mastication**. *Exhibit* a gizzard with the **grit** in it.

XXII.—FEET OF BIRDS

Objects and Apparatus.—The prepared Specimen Feet, and all the Pictures of Birds, dealt with in Stage I.; a Live Parrot (borrowed); a Bamboo and Leg-bone of a Fowl.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Specimens and Pictures.		
(1) The feet of birds have some **common features**—	Observation.	(1) *Comment on* **diversity** of form, and yet *invite discovery* of these **common features.**
(*a*) Combine **strength** with **lightness.**		(*a*) *Illustrate* by **bamboo**—hollow and light, yet very strong.
(*b*) **Generally** have **four toes**, three pointed forwards and one backwards.		(*b*) *Note exceptions*—the **swift** with **all four** pointed forward; the **ostrich** with **only two**, and those forward.
(*c*) **Bare** of feathers, covered **only** with **scales.**		(*c*) ,, Owls and grouse have **feathered feet**, as they **never** run **on muddy ground** and can keep feathers clean.
(*d*) Armed with **claws.**		(*d*) *Note diversity* of claws—**strong talons** (eagle), **blunt** (fowl), **curved** (perchers).

FEET OF BIRDS—*Continued*

Objects and Apparatus.—The prepared Specimen Feet, and all the Pictures of Birds, dealt with in Stage I.; a Live Parrot (borrowed); a Bamboo and Leg-bone of a Fowl.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) A **fowl's** foot is **rough** and **strong**—	Observation.	(2) *Exhibit* **prepared foot** of a fowl. (If possible, bring in a **live fowl** to notice it **lift its foot** up.)
(*a*) With **blunt claws.**		(*a*) *Note* bluntness, **worn down** by much scraping and scratching in the ground.
(*b*) And **closes in a grasp** when the **leg is bent** (even when raised in walking).		(*b*) *Experiment* with **prepared foot**; *pull* the white, flat, cord-like muscle to make the toes clasp.
(3) A **duck's** foot is **webbed** (like those of all swimming birds).	,,	(3) *Exhibit* **prepared foot** of duck or **goose**, and the picture of the bird.
(*a*) The three forward toes are **short and blunt**, and **joined by a skin.**		(*a*) *Feel* the **strength and texture** of web. *Compare* to a **paddle.**
(*b*) On **short legs set well back** underneath the body.		(*b*) *Compare* to position of a **screw propeller** under **stern** part of a ship.
(4) A **sparrow's** foot is **slender** and fairly **long.**	,,	(4) *Exhibit specimens or pictures* of the feet of **any** of the **perchers.**
(*a*) **Curves** round when closed into a **firm grasp.**		(*a*) *Note* **slenderness** to agree with **general lightness** of the bird, and yet the great **grasping power** by which the bird can **secure** itself upon any twig or **branch.**
		Recall the **automatic action** whereby the bending of the leg closes the grasp and makes it **impossible** for a fowl or a perching bird **to fall off** a perch until it stands up.
		Note **exception** of the **skylark,** whose straight toes preclude perching—hence it **runs** along the ground, while other **perchers only hop.**

A Duck's Foot.

A Hen's Foot.

A Sparrow's Foot.

(5) The foot of the **parrot** or **woodpecker** has four strong **curved toes** and claws.
(*a*) Arranged **two forward** and **two backward.**

An Eagle's Foot.

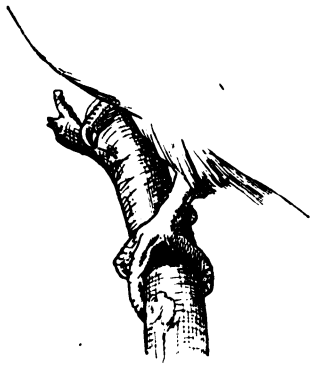
(6) The **talons** of **birds of prey** are strong, curved, and sharp.

(7) The **stilt-like legs** of **wading birds** have long, **spreading toes.**

(8) An **ostrich** has **only two toes,** very **strong and blunt,** pointed forwards.

,,

(5) *Exhibit, if possible,* a **living parrot,** and a **picture** of a **woodpecker** clinging to bark of a tree.
(*a*) *Note* this **exceptional arrangement** of toes.
Compare with foot of **owl,** the talons being not only curved and sharp, but **highly retractile,** and the **outer toe** having the power to be used **either backward or forward.**



Leg and Foot of Parrot.

(6) *Exhibit* **pictures** of eagle, owl, and other **birds of prey.**
Note that when these birds **pounce** on their prey, the **claws are self-acting,** and in their "grasp" **pierce** the vitals.

(7) *Exhibit* picture of **heron** as best example.

(8) *Exhibit* picture of **ostrich,** and *note* the peculiarity of the toe—**approaching** to the **solid hoof.**

STAGE II.—Why Birds' Feet Vary.

(1) A **fowl** needs strong, rough, blunt toes for **scratching up food.**

Questioning.

(1) What are fowls **always doing** with their feet, especially on **refuse heaps?**—(Scraping and scratching.) **Why** do they **scratch?**—(To **find grains,** insects, and scraps of food.) What might **we call these** poultry birds—fowls, pigeons, turkeys—and even our game birds of the same nature—pheasants and partridges—**because they are always scratching** up the ground?—(Scratchers, or scratching birds.)

FEET OF BIRDS—*Continued*

Objects and Apparatus.—The prepared Specimen Feet, and all the Pictures of Birds, dealt with in Stage I.; a Live Parrot (borrowed); a Bamboo and Leg-bone of a Fowl.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) **Swimming birds** have **webbed feet** to act as **paddles.**	Questioning.	(2) Where do ducks and swans **spend most of their time?**—(On the **water.**) **How** are they **enabled** to do so?—(Have **webbed feet** and are good swimmers.) What do they **find much** of **in the water?**—(**Food.**) *Name* some **wild** swimming birds.—(Widgeon, teal.) And some **sea swimmers.**—(Gull, albatross.)
(3) **Perching birds** have **three** long, jointed, **slender toes in front,** and a shorter **one behind** to act as our thumb does in **grasping.**	,, Telling.	(3) *Question* out all that was **observed in the experiment** with the fowl's foot. *Explain* **mechanical action** (i.) The flat white muscle was tough and inelastic. (ii.) When pulled the toes closed, and when let go stretched out again. (i.) In the **living bird** this **muscle** passes up the leg, **over the knee-joint** to the great muscle of the thigh. (ii.) Therefore **in the act of sitting** the bird must **bend the knee-joint,** which pulls up the cord and **closes the toes** of the feet **without any effort** of the bird itself. (iii.) **Result—perchers** clasp when they sit down, and **cannot unclasp till they stand** again. **Seizers,** when they **pounce** on prey and fly off with it, naturally **draw it up close** to their bodies to assist their flight, and **so talons are closed** in the flesh of the victim.
(4) **Climbing birds** have **two** toes directed **forward,** and **two backward,** and can thus run about and **cling** to trees with **utmost safety** as the monkey does with four hands.	Questioning.	(4) *Ask* if a **parrot** looks gainly or awkward when **attempting to walk** on a flat, level **floor?**—(**Hobbles awkwardly.**) When does it **look nimble** in its movements?—(**Climbing.**) How are its feet **formed for climbing?**—(Two forward and two backward.) **What else assists** its climbing?—(Its **hooked**

		beak.) What is the **natural food** of the parrot?—(**Nuts**.) So where must it **spend most of its time**?—(On trees.) If the **woodpecker has to search under the bark** of trees for insects, what must it be able to do **like the parrot**?—(**Climb.**) Will the **rough bark aid** or hinder its climbing and **clinging**?—(Aid.)
(5) The **seizers**, or birds of prey, have **strong, sharp, cruel talons.**	,,	(5) **Why** should birds of prey be **called the seizers**?—(They **seize** their **victims** by pouncing on them.) **What else** about them **look cruel** besides their hooked **beaks**?—(Their cruel **talons.**) For what do **they use them**?—(To assist beak in **tearing** and rending their **prey.**)
(6) The **waders** have **spreading toes** set on **stilt-like legs.**	,,	(6) Besides the swimming, **what** other **class of birds** find **food** in the water?—(**Waders.**) To wade, what **kind of legs** are required?—(Long ones.) And **to keep from sinking** in the mud, should the **toes** be small, or spread out wide?—(**Spread.**) **Why** do these birds, the heron, the stork, and the crane, **also need long necks** and long bills?—(To **reach down** to the water.)
(7) The **runners** have **powerful legs**, and two or three **short, thick toes**; they run but **never fly.**	,,	(7) If a **bird**, such as the ostrich, **never flies**, what must it be **able to do well**?—(**Run.**) **Which** will be the **more powerful**, its **wings** or its **legs**?—(Legs.) Of all the birds mentioned **which** will be **able to run** as well **as a horse does**, and to **kick** as hard as a horse?—(Ostrich.) Of all the birds' feet, **which** come **near in solid appearance** to the solid **hoofs** of a horse?—(Those of the ostrich.) And **which class** of birds has **spreading feet**, like those of the **camel**?—(Waders.)
STAGE III.—Recapitulation and Additional Information.		After *recapitulatory review* to impress main points, it *may be added*—
(1) In **birds** the two **fore limbs** are generally used for **locomotion.**	Telling.	(1) *Except* the **ostrich** and emu—their wings being comparatively weak.
(2) **Therefore** if any limb is to be **used like a hand** it must be the **hind one.**		(2) *Recall* the **"hand uses"** made of their feet by seizers, climbers, scratchers, and even perchers (as the canary with chickweed, or the blackbird with a worm).

FEET OF BIRDS—*Continued*

Objects and Apparatus.—The prepared Specimen Feet, and all the Pictures of Birds, dealt with in Stage I.; a Live Parrot (borrowed); a Bamboo and Leg-bone of a Fowl.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) The **feet of birds** are so **important** a part of their structure, they **aid** (like the beaks) in their **classification**; thus we have—		(3) *Scholars* are now, under Teacher's guidance, *to do the classifying.*
(*a*) Scratchers.		*Name*— (*a*) Barn-door **poultry** and **game birds.**
(*b*) Perchers.		(*b*) Our small **birds of the air.**
(*c*) Climbers (Scansores).		(*c*) **Parrot,** macaw, cockatoo, parrakeet, **woodpecker, cuckoo.**
(*d*) Seizers, or birds of prey.		(*d*) **Eagle,** hawk, falcon, kite, **owl.**
(*e*) Swimmers, or web-footed birds (Palmipedes).		(*e*) **Swan,** goose, duck, teal, widgeon, **gull.**
(*f*) Waders, or stilt-legged birds (Grallatores).		(*f*) **Stork,** crane, heron, adjutant-bird.
(*g*) Runners (Cursores).		(*g*) **Ostrich,** emu.

XXIII.—A FEATHER

Objects and Apparatus.—Feathers (every scholar to have one—the Quill Feather of a Goose or other large Bird will be best); Ornamental Feathers used in Trimming; Downy Bed Feathers.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of a Feather. (1) A **feather** consists of **three parts,** viz.: (*a*) A **hard stem,** or middle part, which is **hollow,** and is called the **quill** or barrel.	Observation.	(1) *Distribute* feathers *round the class.* (*a*) *Compare* with the stem or **trunk of a tree**; and the **point** which was **embedded** in the skin of the bird *compare* with the **root** of the tree, or with the **root of a hair.**

(*b*) A **continuation** of this **hard centre part** to the tip of the feather: this is called the **shaft**, and it—

(i.) Is **four-sided** and slightly **curved.**

(ii.) Is of the **same horny nature** as the quill, but filled with a light elastic substance called **pith.**

(iii.) Has springing from **two opposite sides** some **web** or leaves (**barbs**) lying very **regularly and close together.**

The **barbs** of the web are **subdivided** into "**little barbs**" (barbules).

The **barbules** are like **little hooks**, and **interlock** the web.

(*c*) **Fluffy barbs** (called **accessory plumes**) grow out at the point **where the shaft joins the quill.**

(*b*) *Note* that in some feathers the **shaft** is fine, **tapering**, and **curled round** (not merely curved).

Note **glossy** upper and under sides—the **other sides** sending off long slender **barbs, right and left.**

(i.) *Note* **alteration of form** from the round tube of barrel part; *note* **curvature for fitting the body.**

(ii.) *Cut open* the shaft *to disclose* **nature of pith**—white, light, tough, and buoyant as cork.

Strip off **one of the webs** *to show* that the **shaft is angular,** and not round.

(iii.) *Show* that the **web** consists of **plates,** with their **flat sides** towards each other, **tapering** to a point at their outer ends.

Let scholars pluck these little **leaves separate,** *to examine* them. *Call* them **barbs.**

Note that they **always** point in the **direction of the tip,** and away from the quill.

Run the finger along the feather the **wrong way,** to *show* how it **ruffles.**

Draw fingers along the **right way** *to show* how the web **lies smooth** and even again.

Examine the **barbs** *minutely to discover* projecting **fibres along both edges.**

Repeat experiment of ruffling the web the wrong way—let *close inspection discover* that the **ruffling is really the pulling asunder of the interlocked barbules.**

(*c*) *Note* **downy nature,** and **absence** of that **regularity** which characterises the barbs of the web.

STAGE II.—The three kinds of Feathers on a Bird, and their Uses.

(1) The large **quill feathers** of a bird are found in **the wings and tail,** and are **used for flight.**

Questioning.

(1) From **what parts** of the bird do such **large,** strong, horny **feathers** as these **quills come?**—(Tail, wings.) For **what purpose** does a bird **need** strong **quill feathers?**—(Flying—beating the air.)

A FEATHER—*Continued*

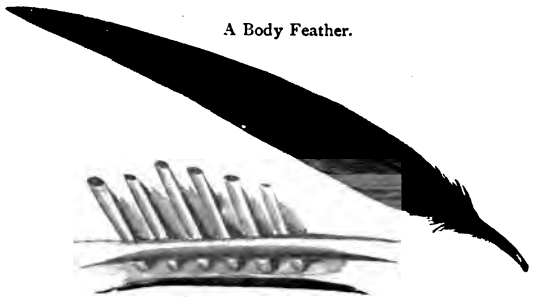
Objects and Apparatus.—Feathers (every scholar to have one—the Quill Feather of a Goose or other large Bird will be best); Ornamental Feathers used in Trimming; Downy Bed Feathers.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		Liken **spreading quill feathers** to a **fan**—used to beat the air. *Compare* with **rays** of a fish's **fin**. *Exhibit* a **quill feather**, side by side with a **body feather**, and a bit of the **under down**.
(2) The **body feathers** are much **smaller**, and are used merely as **a covering**, or clothing, for the bird.	Questioning.	(2) If you felt the **other parts** of a bird's **body**, would the **feathers** there be larger or **smaller?**—(Smaller.) Stronger or **weaker?** (Weaker.) If **not large and strong**, such as are used in flight, **what** are these smaller ones **used for?**—(Clothe the body.) **To what**, on an animal such as **a cat**, may we **compare** these **body feathers?**—(Fur.) A Quill Feather.
(3) **Beneath** the covering feathers grows some **soft down**, for giving **greater warmth** to the bird.		(3) If we **looked** at the **skin** of a bird, underneath the clothing feathers, what should we **find there?**—(**Smaller feathers.**) **Suppose** we **buried our fingers** in the thick feathers of a duck's breast, **what should** we **notice** about the feathers there?—(Very **soft and downy.**) **Would** the **hand feel** cold or **warm** there?—(Warm.) So **what is the use** of these soft downy feathers?—(**Warmth.**)
(4) The **general design** of a bird's clothing is a combination of **lightness and strength**:	,,	(4) To what do we **often compare things**, when we wish to say they are light?—(**Light as a feather.**) Yet **when we cut open** a feather, do we find it weak and soft, or hard and tough?—(**Hard and tough.**)
(*a*) For the **purposes of flight**,		(*a*) In **which direction** do feathers **grow on a bird?**—(From head to tail.) Does this **arrangement aid or**

(*b*) And **warmth.**

hinder flight?—(Aid.) **If** feathers were **arranged in any other direction**, what would happen when the **bird flew swiftly** in a forward direction?—(**Ruffle.**) And **what have** the barbs to **assist** in keeping them down **smooth on the** body?—(**Hooked barbules.**)

(*b*) Do birds find it warmer or **colder high up** in the air?—(Colder.) **When you plunge** your **hand** into soft feathers, **what else do you notice** besides their softness?—(**Warmth.**) Besides being a **suitable covering** for birds by reason of their **lightness,** what **necessary** quality have they?—(**Warmth.**)



A Body Feather.

Insertion of Feathers.

A Down Feather.

STAGE III.—Feathers of Commerce.

(1) The **commonest kinds** of feathers in use are the **plume feathers** of the **poultry** birds and **tame waterfowl**; they are used for **stuffing beds,** pillows, and cushions.

Questioning.

Telling.

(1) *Question out* the **commonest kinds,** most frequently seen in use; **their uses** in **upholstery**; and arrange them in their **order of commercial value**—goose feathers, then duck feathers, and lastly fowl feathers.

Discover that **water-fowl** have thick and soft feathers on their **breasts**—hence **greater value.**

Tell that they are **dried, shaken** soft, and **baked** to destroy vermin [or taint.

A FEATHER—*Continued*

Objects and Apparatus.—Feathers (every scholar to have one—the Quill Feather of a Goose or other large Bird will be best); Ornamental Feathers used in Trimming; Downy Bed Feathers.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) The **quills** of the goose and the swan are **used as pens,** toothpicks, floats for fishing lines; sometimes the finer **crow quill** is used for **drawing.**	Telling.	(2) *Tell* that the **steel pen** is quite a **modern invention.** *Derive* name "**pen**"-**knife** from its use to point the **nibs** of quill-pens. *Infer* that **delicate lining** may be performed by the use of a **smaller quill,** such as that of the crow.
(3) **Swan's down** is used for making **powder-puffs.**	,,	(3) *Admire* the **beauty** and softness of **texture** in a **powder-puff.**
(4) **Eider down,** obtained from Norway and Iceland, is largely used to line **bed-quilts.**	,,	(4) *Describe* **eider duck** as twice the size of the ordinary duck, and found from Greenland to the **north of Europe,** making its **nests** of drift-weed along the rocky coasts; five **eggs** are laid, which the bird **protects from cold** with **down scratched** from its own breast. The natives **rob the nest** of eggs and down; the **bird repeats** her labours, and sometimes is robbed a second or a third time before removing to a safer breeding place. The down of a **dead bird loses its elasticity** and is of little commercial value. In commerce a **ball of down** the size of a man's **fist** weighs 3 lbs. or 4 lbs., and is valued at £3 or £4. If **expanded carefully** over a coal fire will **yield enough down** to stuff several coverlets. It is highly esteemed for (*a*) **lightness,** (*b*) **softness,** (*c*) **warmth,** and (*d*) **elasticity.**

A Bird's Wing (Open).

A Bird's Wing (Shut).

(5) **Ornamental feathers** are largely used for **trimming** hats and bonnets; ostrich feathers being of such value that the birds are farmed in South Africa.	,,	(5) *Condemn* the **wanton slaughter** of pretty birds for **mere adornment** of our persons. *Show* that by **farming ostriches**, the feathers are obtained **without killing** the birds—feathers they would **otherwise shed** from tails and wings. *Allude* to the heraldic plumes known as **"Prince of Wales' feathers"** as an example of use in personal adornment.

Recapitulate for Chief Points of the Lesson.

XXIV.—SNAIL AND SLUG

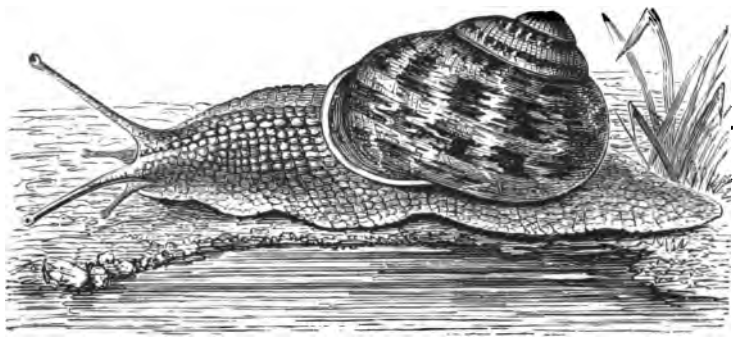
Objects and Apparatus.—Snails and Slugs on a Piece of Wet Glass; variety of Snail Shells, one sawn across to show interior; a Leather Sucker; a Rasp File; Snail-eaten Leaves; Periwinkle and Whelk Shells; some Water with Powdered Chalk in it; a Glove.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Specimens.	By Observation and Experiment.
(1) The **snail** has a **soft body** (no internal skeleton), protected by a **hard shell.**	(1) *Observe* that the snail is **not entirely shut in its shell**, as is the crab in its crusty armour.
(2) The snail's **head** and part of its **body** (the **foot**) can be **pushed out**; and when he moves, **"he carries his house on his back."**	(2) *Induce* a **snail to move** towards some green food placed on the piece of wet glass. *Note* the parts **outside** the shell, (*a*) the **head**, and (*b*) **body.**
(3) The **body** is **oval**, and, while it can be **drawn entirely into** the shell, **cannot** wholly **leave it**, being **fastened** by portions of **skin.**	(3) *Touch* a snail *to make it* **shrink back** into its shell. *Observe* that the soft **body** becomes **coiled, to fit** into the coiled **shell.**
(4) Snail **shells**— (*a*) **Vary** in **size and colour**: (*b*) **Consist** of **whorls** round an axis, and **marked with lines.** (i.) The **larger**, starting from the lip, is the **body-whorl**; (ii.) Then comes the **spire**, (iii.) **Terminated** by the **apex**, or point.	(4) (*a*) *Compare* with the more **uniform periwinkle** and whelk shells. (*b*) *Point out* these **spiral** turns of the shell, and particularly *examine* the **lines** (of **growth**). (i.) *Show* how easily the **body can slip inside** the large whorl through the wide **lip.** (ii.) (iii.) *Pass round* specimen shells, and exhibit **the shell cut through** lengthwise, *to disclose* the **winding form** round a **central column** (like a **corkscrew**).

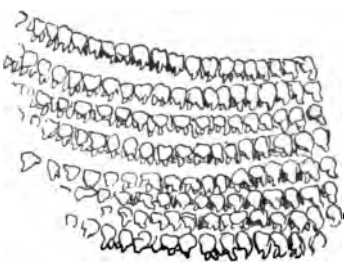
SNAIL AND SLUG—*Continued*

Objects and Apparatus.—Snails and Slugs on a Piece of Wet Glass; variety of Snail Shells, one sawn across to show interior; a Leather Sucker; a Rasp File; Snail-eaten Leaves; Periwinkle and Whelk Shells; some Water with Powdered Chalk in it; a Glove.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(5) When the snail **moves**— (*a*) It is with a **wavelike glide**: (*b*) On the underside of the body (**the foot**), which is thick and muscular, **acting like a sucker**, and enabling it to **climb**:	(5) *Induce* a snail **to move along the glass** for observation; *hold* the glass *high enough* for children to **see the method of progression** through the glass. *Experiment* with a wet **leather sucker** *to demonstrate* its power of **holding.**



The Common Snail (*Helix aspersa*).



Jaws of a Snail, showing Teeth.

(*c*) The **crawling** being effected by the **pucker** of the foot in the middle, then **push-and-pull movements** succeeding each other, head and tail **moving forward** in succession.	*Show* the **slimy trail** left behind (a piece of wet, rough roof slate will **perhaps induce** the **secretion of the slime,** if the glass does not do so).

(6) The snail has—
(*a*) A distinct **head**, with a **mouth**:
(*b*) Four soft **horns** (tentacles), the upper pair being the longer:
(*c*) The upper pair having **eyes that run up** to the tip of them like little black beads.

(7) The **slug**—
(*a*) Has a sort of **hard hump** on its back instead of a shell:
(*b*) Is sometimes **black** and **red**, as well as **grey**:
(*c*) Is **like the snail** in many **other respects**.

(6) (*a*) *Touch* the **head**, and *note* that it is **withdrawn** into the shell for **protection**.
(*b*) *Observe* that they are **soft**, like the rest of the body, and **not** at all "**horny**."
(*c*) *Experiment* to see this **action of the eyes** running up as soon as the snail puts forth its head from the shell.

(7) (*a*) *Say* that slugs look like "**snails without shells**."
(*b*) **Black** slugs may be found in **meadows and hedges**, and **grey** ones in **gardens**.
(*c*) *Note* **similarity of horns** and general **structure**.

STAGE II.—Snail: Structure and Habits.

(1) The snail belongs to **one-shelled** (univalve) **soft-bodied animals** (molluscs).

(2) It belongs to the **belly-footed** group of these soft-bodied animals; as it **cannot walk on anything dry**, it pours **slime** from its body to make a trail to walk upon.

(3) The body is **attached** to the shell by an **outside** fold of **skin** called the **mantle**.

(4) By this mantle the **shell is increased** in size (and **coloured** from paint-glands) **as the snail grows**. The **new layers** may be **seen** on the shells, showing how they are **built** from the spire **downwards towards the lip** or opening.

(5) The **breathing organ** opens outside the body near front of the mantle.

BY QUESTIONING, TELLING, AND COMPARISON.

(1) *Compare* with **whelk**; *contrast* with **oyster**, mussel, and cockle.

(2) *Question* on **movements** of this "belly-foot" (*note if necessary* that the cuttle-fish is **head-footed**).
Memory will recall **observation** of **slimy tracks**.
Reason out that as the creature **never wastes its slime** (*a*) it stays at home on **dry days**, and (*b*) goes out in search of food **after rain**.

(3) *Show* appropriateness of the **name** "mantle."

(4) *Explain* that the **young snail sweats out** of its body a thin **fluid** containing chalk, and the watery part drying up, **leaves the solid chalk behind**.
Experiment with a vessel of **chalky water**, boiling off the water over a flame.
Connect the **lines of growth**, observed on the shells, with this simple method of formation.
Tell that a snail **cannot live with a dry skin**.
Compare with the **spider**, which **builds** its **home** out of the **products** of its **own body**.
Draw attention to **varying colours** of the shells. *Compare* with **pearl** in oysters.

(5) *Explain* that this brings the **blood, for purifying**, in contact with the **air**. *Compare* with our **lungs**.

SNAIL AND SLUG—*Continued*

Objects and Apparatus.—Snails and Slugs on a Piece of Wet Glass; variety of Snail Shells, one sawn across to show interior; a Leather Sucker; a Rasp File; Snail-eaten Leaves; Periwinkle and Whelk Shells; some Water with Powdered Chalk in it; a Glove.

MATTER SUMMARISED.	DETAILED HINTS AND SUGGESTIONS.
(6) The **upper pair of horns** having the **eyes** are **seers**; the **short pair** are merely **feelers.**	(6) *Illustrate* the contraction of the **muscle** which **withdraws the eye** in to horn by drawing the tip of a **glove finger** down from the inside. *Compare* with **stalked eye** of crab. *Compare* **feelers** with **whiskers** of a cat, or **antennæ** of an insect.
(7) The **jaws** are horny, and the **tongue** is ribbon-like, with hundreds of rows of **teeth** (over 14,000 in all) set back, and acting like the **rasp** of a file for **boring and cutting vegetable food.**	(7) *Display* some **snail-eaten** leaves. *Illustrate* by **filing** a piece of **wood.** *Note* destructiveness to **garden vegetation.**
(8) The snail **sleeps through the winter**— (*a*) In some **snug position** in crack or crevice. (*b*) First **shutting itself in** the shell by forming a **door** of skin from its **slime.**	(8) (*a*) *Obtain* likely **hiding-places,** as holes, thatches, and tree-roots. (*b*) *Note* that often **two or three** skin **screens** are formed, always with a **tiny air-hole** through. *Question* on **security, warmth,** and **breathing** facilities thus provided. *Compare* with **other winter sleepers.** *Note* that snail becomes **dormant at will,** as in drought.
STAGE III.—The Slug.	By Questioning, Telling, and Comparison.
(1) Though **all** snails and slugs are **hatched with shells,** they seem to **disappear from slugs.**	(1) *Explain* that really they remain **hidden in the mantle** (*pallium*). *Explain* that if cut open, **inside** will be found a **flattened shell.** *Compare* with **limpet.**
(2) Slugs, like snails, are **creatures of the night,** and equally **destructive.**	(2) *Memory* will recall how they **hide** in **day**-time, and **come out** at **night,** especially when **dewy.**
(3) Their **air-opening** is on the right side of mantle.	(3) *Compare* **lung slit** on snail and on slug.
(4) Slugs' **eggs** may be found in the crocks at the bottom of flower-pots Snails' **eggs** may be found in damp places below the ground } **in spring.**	(4) *Describe* as similar to **peas** of soft **jelly,** like glass beads. Sometimes the **baby snail** may be **seen within**—a minute creature with a tiny shell.

STAGE IV.—Recapitulatory, with Additional Information.

(1) These creatures are **highly organised** with a heart, digestive canal, and a nervous system—

(2) And **serve some useful purposes** in nature; as—

(*a*) **Checking overgrowth** of dense vegetation in virgin **forests.**

(*b*) **Supplying food** to birds, reptiles, and other **creatures.**

(*c*) Providing a **human food** in France; and possibly a **medicine.**

BY QUESTIONING, TELLING, AND COMPARISON.

After *questioning* on *what was observed,* and then *what was told* in relation to each observed fact, *it may be added*—

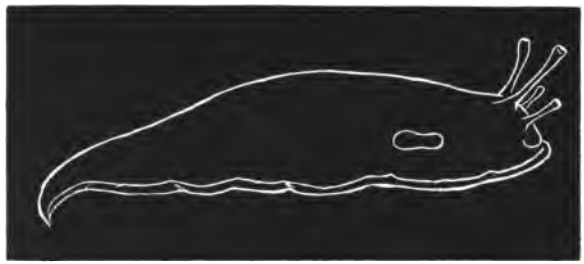
(1) *Briefly explain* **circulatory** systems, **digestive** organs, and **nervous** systems (inculcate restraint from **cruelty** to any **creature which can feel**).

(2) *Apply* the general truth that **all creatures** must have a **use in nature.**

(*a*) *Describe* the **darkness** of a dense forest, and the use of snails to **let in light and air.**

(*b*) *Enumerate* the **creatures which eat** snails and slugs.

(*c*) *Tell* that in **France** the Vine Snail is **cooked and eaten;** and *mention* the attempted **cure of consumption** by administering snails.



Outline of a Slug.

XXV.—BUTTERFLY

Objects and Apparatus.—Prepared Specimens of Butterflies and Moths; Butterfly's Eggs, or Enlarged Drawings of them.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of a Butterfly.		
(1) A butterfly is an **insect** with **large wings.**	Observation.	(1) *Observe* that the creature is an "insect" "**cut into**" the **three parts** of head, chest, and belly, to be pointed out. *Note* that the **wings** are much **larger than is usual** with other insects—varying in **shape and colour according** to their **kind.**
(2) The **wings** of a butterfly are covered with a mass of **small scales** like **coloured** dust laid in **patterns.**	,,	(2) *Experiment* by **touching a wing** with the finger, and *noticing* how the **mealy dust** comes off, and leaves the **wing beneath** as **transparent** as those of a house fly. *Admire* the **velvety patterns** formed by these **scales.**
(3) The butterfly has a **trunk** (or *proboscis*) with which **to suck honey** from the flowers.	,,	(3) *Compare* with the **house fly**—both belong to the **sucking division** of insects—they are **not chewers** (mandibulata) like the beetles, with strong jaws for eating solid food.
(4) **Projecting** from the head are **two feelers** (*antennæ*), each **terminating** in a tiny **knob.**	,,	(4) *Compare* with other "**feelers.**"
STAGE II.—Questioning on the Foregoing Examination.		
(1) A butterfly is a **pretty insect.**	Questioning.	(1) If you were asked **what insect** had a most "**fairy-like form,**" which would you say?—(Butterfly.) What does the **latter part** of the name, "**fly,**" at once let us know?—(That it flies.) **Why** do insects **need to fly**?—(To search for widely **scattered food.**)
(2) It **flits** from flower to **flower, sipping** the **honey** it finds.	,,	(2) What **kind of food** will it **require** if it has a sucking trunk?—(**Fluid.**) **Where** is sweet **fluid food,** such as bees and butterflies like, to be **found?**—(In flowers.)

(3) Its **feelers protect** its delicate wings **from injury** as it flutters about.	,,	(3) Besides **beauty of form**, how has the butterfly **beauty of colour**?—(Tiny **coloured scales decorate** wings.) **How** do we **know** the colouring **scales are not engrained** in the wings?—(Easily wipe off.) How are these **delicate scales** and **fragile wings protected** on an insect which is fluttering about?—(By **feelers.**)
	Telling.	*Tell* that these tiny **scales** are of **different shapes and colours,** each with a **footstalk** to attach it, placed in **thousands of regular rows,** and **overlapping** like tiles on a roof. (Microscope needed to see them.)
STAGE III.—Structure and Life-history of a Butterfly.		
(1) Butterflies are known as "**scaled insects**" (*Lepidoptera*); there are many different kinds, but **all** are **alike** in their **life-history.**	Telling.	(1) *Lead up* to **appropriateness** of class **name,** "scaled insect," from previous step. *Say* that it is now purposed to **detail** the life-history of the **cabbage-white butterfly** as a common type.
(2) **Egg stage**— (*a*) **Eggs** of insects are **always laid** where the **young,** on being hatched, **can** immediately **find food,** as the mother dies soon after depositing her eggs.	,,	(2) *Exhibit* some **butterfly's eggs** (microscope reveals them **like ivory** carved and embossed, in **various shapes** but **never oval,** or true egg-shaped). (*a*) *State* that this particular butterfly **deposits a cluster** of four to ten eggs on the **underside** of a **cabbage leaf.** *Derive* **name** hence. *Mention* that the young grubs sometimes make their **first meal** upon the **egg shells** from which they are just hatched.
(3) **Grub stage**— (*a*) Lasts two or three months, during which the **caterpillar eats greedily** day and night, **growing** all the time.	,,	(3) (*a*) *Infer* that the **food** must be the **cabbage leaf.** *Exhibit* a **caterpillar-eaten leaf,** if procurable. *Emphasise* the **voracity** of the creature.
(*b*) Suddenly **appetite fails,** caterpillar becomes **sluggish,** its colours go **dim,** its **skin bursts** along the back, and out wriggles the worm in **a bright new coat.**	,,	(*b*) *Enumerate* these **four symptoms,** *for children to restate* to the teacher. *Recall* the eating of the empty egg-shells—then tell that the transformed worm **eats the cast skin** in same way.

XXV.—BUTTERFLY

Objects and Apparatus.—Prepared Specimens of Butterflies and Moths; Butterfly's Eggs, or Enlarged Drawings of them.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of a Butterfly.		
(1) A butterfly is an **insect** with **large wings.**	Observation.	(1) *Observe* that the creature is an "insect" "**cut into**" the **three parts** of head, chest, and belly, to be pointed out. *Note* that the **wings** are much **larger than is usual** with other insects—varying in **shape and colour according** to their **kind.**
(2) The **wings** of a butterfly are covered with a mass of **small scales** like **coloured** dust laid in **patterns.**	,,	(2) *Experiment* by **touching a wing** with the finger, and *noticing* how the **mealy dust** comes off, and leaves the **wing beneath** as **transparent** as those of a house fly. *Admire* the **velvety patterns** formed by these **scales.**
(3) The butterfly has a **trunk** (or *proboscis*) with which **to suck honey** from the flowers.	,,	(3) *Compare* with the **house fly**—both belong to the **sucking division** of insects—they are **not chewers** (mandibulata) like the beetles, with strong jaws for eating solid food.
(4) **Projecting** from the head are **two feelers** (*antennæ*), each **terminating** in a tiny **knob.**	,,	(4) *Compare* with other "**feelers.**"
STAGE II.—Questioning on the Foregoing Examination.		
(1) A butterfly is a **pretty insect.**	Questioning.	(1) If you were asked **what insect** had a most "**fairy-like form,**" which would you say?—(Butterfly.) What does the **latter part** of the name, "**fly,**" at once let us know?—(That it flies.) **Why** do insects **need to fly**?—(To search for widely **scattered food.**)
(2) It **flits** from flower to **flower, sipping** the **honey** it finds.	,,	(2) What **kind of food** will it **require** if it has a sucking trunk?—(**Fluid.**) **Where** is sweet **fluid food,** such as bees and butterflies like, to be **found**?—(In flowers.)

(3) Its **feelers protect** its delicate wings **from injury** as it flutters about.	,,	(3) Besides **beauty of form**, how has the butterfly **beauty of colour**?—(Tiny coloured **scales decorate** wings.) **How** do we **know** the colouring **scales are not engrained** in the wings?—(Easily wipe off.) How are these **delicate scales** and **fragile wings protected** on an insect which is fluttering about?—(By **feelers.**)
	Telling.	*Tell* that these tiny **scales** are of **different shapes and colours,** each with a **footstalk** to attach it, placed in **thousands of regular rows,** and **overlapping** like tiles on a roof. (Microscope needed to see them.)
STAGE III.—Structure and Life-history of a Butterfly.		
(1) Butterflies are known as "**scaled insects**" (*Lepidoptera*); there are many different kinds, but **all** are **alike** in their **life-history.**	Telling.	(1) *Lead up* to **appropriateness** of class **name,** "scaled insect," from previous step. *Say* that it is now purposed to **detail** the life-history of the **cabbage-white butterfly** as a common type.
(2) **Egg stage**— (*a*) **Eggs** of insects are **always laid** where the **young,** on being hatched, **can** immediately **find food,** as the mother dies soon after depositing her eggs.	,,	(2) *Exhibit* some **butterfly's eggs** (microscope reveals them **like ivory** carved and embossed, in **various shapes** but **never oval**, or true egg-shaped). (*a*) *State* that this particular butterfly **deposits a cluster** of four to ten eggs on the **underside** of a **cabbage leaf.** *Derive* **name** hence. *Mention* that the young grubs sometimes make their **first meal** upon the **egg shells** from which they are just hatched.
(3) **Grub stage**— (*a*) Lasts two or three months, during which the **caterpillar eats greedily** day and night, **growing** all the time.	,,	(3) (*a*) *Infer* that the **food** must be the **cabbage leaf.** *Exhibit* a **caterpillar-eaten leaf,** if procurable. *Emphasise* the **voracity** of the creature.
(*b*) Suddenly **appetite fails,** caterpillar becomes **sluggish,** its colours go **dim,** its **skin bursts** along the back, and out wriggles the worm in **a bright new coat.**	,,	(*b*) *Enumerate* these **four symptoms,** *for children to restate* to the teacher. *Recall* the eating of the empty egg-shells—then tell that the transformed worm **eats the cast skin** in same way.

BUTTERFLY—*Continued*

Objects and Apparatus.—Prepared Specimens of Butterflies and Moths; Butterfly's Eggs, or Enlarged Drawings of them.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*c*) The same **process is repeated** several times: namely, the grub eats and grows, stretching its skin till it bursts; eventually the caterpillar ceases to eat and grow.	Telling.	(*c*) *Estimate* the **repetition** at four or five, and the **moults** to occur about every eight or ten days. *Estimate* that the caterpillar **eats many times its own weight** during these two or three months.
(*d*) The grub has twelve **eyes**, and strong, horny **jaws** which open sideways; and **breathing tubes** all over its body.	,,	(*d*) *Note* that a **butterfly** has 30,000 **eyes**. ,, in **all insects** the **mouth** opens **sideways**: *illustrate* by a pair of **shears held horizontally**.
(*e*) The **body** is made up of thirteen **rings**; there are three pairs of **real legs** in front, and some "**claspers**" behind.	,,	(*e*) *Note* the **jointed body** made up of **segments**. ,, **real legs** correspond in number with the **six legs** of the **perfect insect**.
(*f*) The caterpillar now crawls down from the leaf to **find a secure hiding place** on twig or wall.	,,	(*f*) *Infer* that the **green leaf** would be **exposed** and **unsafe**. *Recall* that **some** caterpillars are **hairy** (tiger moth), as **protection** against **birds**, or **falling** from heights.
(*g*) Fastening itself with **silken threads**, it hangs **head downwards**, sometimes with threads round its body, till it **emerges as a chrysalis**.	,,	(*g*) *Estimate* two or three days till **it wriggles out** of its skin as **a chrysalis**. *Give* literal meaning of **chrysalis** as "**golden case**," because of its **glistening tints**.
(4) **Pupal stage**—	,,	(4) *Explain* **pupa** to mean "**a doll**," so called because the creature is now **swaddled** in a hard, shelly case, with **no mouth** to eat, and **no limbs** to move.
(*a*) As a chrysalis or pupa it **remains**, if in **summer** two or three		(*a*) *Infer* that the **transformation** is **delayed** through the cold season **till suitable** summer time returns.

weeks, if in **winter** six or seven **months**.

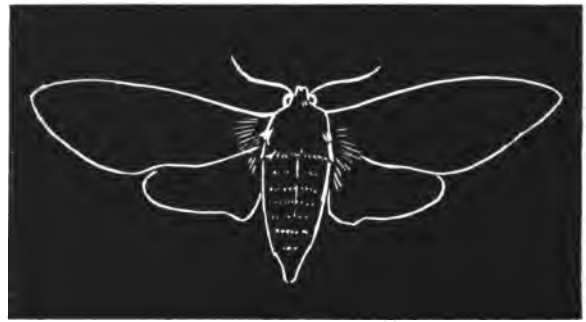
(*h*) The skin **splits** for the **last time**, and out crawls the **perfect insect**, very **weak** and very **crumpled**.

,,

(*b*) *Infer* that wings, legs, and other **parts** have been **folded very closely** in the shelly case.

Teach that **exposure to the air** soon **hardens** and strengthens the creature.

A Butterfly.



A Moth.

BUTTERFLY—*Continued*

Objects and Apparatus.—Prepared Specimens of Butterflies and Moths; Butterfly's Eggs, or Enlarged Drawings of them.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(5) **The perfect butterfly—**		
(*a*) Crawls to some place and **hangs upside down,** where it can work its **wings backwards and forwards,** to **smooth** and harden them.	Telling.	(*a*) *Compare* with the shaking of **creases out of folded linen.** ,, ,, **drying of damp linen** by waving it in the air.
(*b*) In an **hour or so** the insect is **ready and fit** to use **all its power** for the first time.	,,	(*b*) *Glean* that the **chief of its new powers is to fly,** which the grub and the chrysalis could not do.
(*c*) The **wings,** or organs of flight, are **necessary to carry** the mother insect to **fresh feeding grounds** in which to **lay her eggs.**	,,	(*c*) *Prove* this from the fact that **one greedy grub eats so much**—therefore the feeding grounds must be **extended** over a **large area.**
(*d*) The butterfly is **harmless,** incapable of doing mischief like the caterpillar.	,,	(*d*) *Prove* this *by contrasting* its **sucking trunk** with the **horny jaws** of the grub.
STAGE IV.—Recapitulation and Additional Information.		Review for chief points by recapitulatory questioning. Then may be added—
Moths are distinguished from **butterflies** by—		*Exhibit* butterflies and moths side by side to point out these differences.
(*a*) **Darker** and less brilliant **colours** —as moths **come out at night.**		(*a*) *Prove* the **uselessness** of bright **colours** by memory of a flower-bed **viewed at night.**
(*b*) Heavier **bodies.**		
(*c*) Their **feelers** not terminating in a knob.		

XXVI.—BEE

Objects and Apparatus.—Pictures or Dead Specimens of Bees; some Honey, Beeswax, and Honeycomb; Articles made of Wax; Large Flowers to show Pollen or "Flower Dust."

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictures and Objects.		
(1) Bees are in **three sizes**—	Observation.	(1) *Exhibit* pictures, or prepared specimens of each, **side by side** (queen, drone, and worker).
(*a*) The **fewest** to be found are the **largest** in size, the abdomen being **long** and **pointed** (queen bee).		*Point out* these **distinctive features**, one by one, and *compare* side by side.
(*b*) Scarcely more numerous are the **next in size**, their abdomen being **thick but not pointed** (drones).		
(*c*) Exceedingly numerous are the **smallest**, (i.) the abdomen **tapers**; (ii.) **wings** are **shorter** than the abdomen; (iii.) the two **hind legs** have a small **cavity** surrounded by **hairs**.		*Name* **each class of bee** *as* it is *pointed out.*
(2) The **most numerous** class of the hive bees are the **workers**; to their **industry** we are indebted for **honey and beeswax.**		(2) *Pass round* some **honey** to be seen, smelt, and tasted. *Pass round* some **beeswax** to be seen, smelt, and felt. *Exhibit* some **wax candles**, tapers, vestas, wax flowers. *Exhibit* a piece of **honeycomb** protected in a little box, or picture of comb.
STAGE II.—Structure.		
(1) Female or **queen bee**—	Telling.	(1) (*a*) *State* that the queen bee does **not** concern herself **even to direct the tasks** of the hive.
(*a*) Not called "queen" because she rules; she is merely the "**mother.**"		

BEE—*Continued*

Objects and Apparatus.—Pictures or Dead Specimens of Bees; some Honey, Beeswax, and Honeycomb; Articles made of Wax; Large Flowers to show Pollen or "Flower Dust."

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*b*) She lives about four years and fills up her time with **her own work of laying eggs.**	Telling.	(*b*) *Emphasise* her **duties** as purely **maternal.** She is the **only female in the hive.**
(*c*) She moves from **cell to cell,** putting an **egg in each** one.	Questioning.	(*c*) *Question* on the **cells** of the honeycomb exhibited—**size, shape, material,** and **object.**
(2) Male bee or **drone**—	Telling.	(2) (*a*) *Explain* "drone" to mean a **non-worker.**
(*a*) There are **not many** of these.		
(*b*) They have **no sting**; they **live** only a **short time.**		(*b*) *Note* that the bee is one of the **few insects** which **have stings** in their tails: *Note further* that the bee is **chief** of the **fewer** which **make honey.**

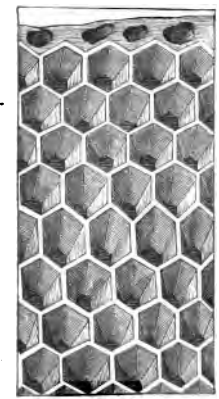
Queen.

Drone.

Worker.

(3) **Neuters** or **workers**—		(3) (*a*) *Reason out* their name "workers," and their **great industry** to produce **such material results.**
(*a*) There are **thousands** of these to one drone, and they **do all the work.**		
A worker has—		
(i.) A **long tongue,** edged		(*b*) (i.) *Liken* to a **tiny brush** dipped into fluid to **soak it up.**

with hairs, to lick **juice from flowers.** (ii.) A cavity in its hind legs, called the **"basket,"** for **carrying pollen** brushed off by the legs, and which is required to prepare **food for the young.**	Questioning.	(ii.) *Question* on **cavity** observed—on its **appropriate name**, "basket"—on the use of the **hairy hind legs.** *Exhibit* **flowers** and **wipe off** some **pollen** on the fingers, or on the chin of a scholar (as children play).
STAGE III.—Bees at Work. (1) **Queen bee** acts simply as mother to the community, laying nearly **100,000 eggs per season.**	Telling.	*Note* that insect life is always **prolific.**
(2) **Workers**— (*a*) Make the **cells** to hold the eggs, and the **food** to be stored therein, to await the hatching of the young bees:	,,	(2) (*a*) *Exhibit* the honeycomb, *showing* some of the **hexagonal cells** empty and some full. *Explain* the syllable **comb** to mean **"a hollow"** or "a cell."
(*b*) Cells are **made of white wax**, got from the bodies of bees, and kneaded with their teeth; the bees hang together in a **cluster** during this operation of making the comb.	,,	(*b*) *Exhibit* a bee (or picture) to show the **wax pockets** situated on the **underside** of the body. *Exhibit* a picture of a **section of a hive**, showing the flattish **cakes of wax** are fixed vertically to the **upper part** of the hive, leaving a **small space** between each, sufficient to allow **two bees to pass** when at work. *Draw* **admiring** *attention* to the **economy** of (i.) **Space**, and (ii.) **Material** in the six-sided arrangement whereby every side does double duty, serving as a partition twice over.



A Section of Honey-comb.

Objects and Apparatus.—Pictures or Dead Specimens of Bees; some Honey, Beeswax, and Honeycomb; Articles made of Wax; Large Flowers to show Pollen or "Flower Dust."

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*c*) The **honey** collected is a sweet fluid called **nectar**, sucked out of flowers;	Experiments.	(*c*) *If possible* have some **clover blossoms** *distributed* for scholars **to suck** out the "honey."
(i.) It is changed into **honey** in their honeybags, or	Questioning.	(i.) *Discover by question* that the **object of storing the honey** is to provide winter food.
(ii.) Transformed into **wax**.		(ii.) *Discover by question* that the **object of making wax** is to form the egg-cell or honeycomb.
(*d*) The young bees are first fed on **bee-bread**, a mixture of honey and pollen.	,,	(*d*) *Question* on the collection of **pollen**—*lead up* to **its use.**
(*e*) Some workers are **nurse bees** for tending and feeding the helpless young.	,,	(*e*) *By questioning show* that if there is **special baby food**, there must be baby tenders or **nurses.**
STAGE IV.—Life Stages of a Bee.		
(1) The **egg** having been placed in a cell, in three days it is hatched into a grub (larva).	Telling.	*Say* that **all insects** go through the **same stages of life**—egg, grub, chrysalis, and perfect insect.
(2) This little **white grub** is constantly fed on bee-bread by nurse bees.		*Point out* the **peculiarities** which seem to distinguish **bees**, viz.:
(3) After five days of eating and growing, the nurses **seal up** the cell.		(i.) The **place for depositing the eggs** is specially built, like a nest (cell of honeycomb).
(4) The larva spins a silky **cocoon** in about thirty-six hours, and in three days becomes a **chrysalis.**		(ii.) **Food** and **nurses** are specially **provided** for the young.
(5) In twenty days from the laying of the egg, the chrysalis **changes to a perfect bee.**		*Compare* with **wasps**, which build a nest, not of wax, but of a kind of paper they make.
(6) The **young bee** is tended and fed by **nurses** another twenty-four hours, and is then **ready for work.**		

STAGE V.—Bee-keeping.		
(1) Bees are kept in **hives**, for the **profit** of man.	Telling.	(1) *Contrast* with **humble bee.** Fancifully *designate* a swarm of bees **"a poor man's herd."**
(2) Such large **quantities of honey** are collected and stored for winter use by the bees, that **no harm** is done by **taking the surplus** not needed for their sustenance.	,,	(2) *Demonstrate* that **no harm** is done—*inculcate* **kindly treatment** of all living creatures.
(3) When bees have **increased** so as to be **too many** for the hive, the **queen goes off** (between May and July) with a large number to **find a new home.**	,,	(3) *Tell* that this is called **"swarming"**; and that bee-keepers get empty **hives in readiness.**
(4) By **bee farming** we secure two useful products—	Questioning.	(4) *Obtain* **examples of each,** as—
(i.) **Wax,** used in manufactures.		(i.) Candles, matches, dolls, waxwork figures, moulds for casts, furniture paste, &c.
(ii.) **Honey**, a food-stuff.		(ii.) Eaten on bread, or used to sweeten other food (before sugar was used), or to make a beverage (mead).
Stage VI.—Recapitulation.	Questioning.	In recapitulation *refer* to the prudence and **industry** of the insects giving us such phrases as "busy bees" and "hives of industry." *Allude* to their aid in the **fertilisation of flowers.**

XXVII.—INSECT DEVELOPMENT

Objects and Apparatus.—Pictures of Birds and their Nestlings; Preserved Specimens of Eggs, Larvæ, Pupæ, and Insects mounted in Sets on Cardboard, or Enlarged Drawings of same; Living Insects.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Introduction.		
(1) **Some creatures lay eggs,** from which their young are produced.	Questioning.	(1) *Question* on the laying and hatching of **birds' eggs.** *Ask* what **other creatures** lay eggs. *Collect* the answers (**fishes, frogs, insects**). *Arrive* at the fact that the **young produced from eggs** are those of— (*a*) **All birds, soft-bodied animals** (such as oysters) and **jointed animals** (such as crabs). (*b*) **Most fishes** and **reptiles.**
(2) **Insects are produced from eggs,** but go through **several changes afterwards,** before becoming perfect.	,,	(2) *Include* **insects** among the **jointed animals,** *after questioning* on their jointed **segmented bodies,** and their **jointed limbs.**
(3) The **changes** or transformation are **generally three**; these are— (*a*) The egg stage. (*b*) The larval or grub stage. (*c*) The pupal stage— before maturity.	,,	(3) *By questioning discover* that **chickens** are hatched fluffy, but **strong** and **resembling parent** birds. *By questioning discover* that **many birds** are hatched **naked** and **helpless,** but with all the **parents' features.** *Contrast* **insects**—*exhibit,* by specimens or drawings, the **stages of development**; and *name* them (*note* that there are **incomplete** changes or **metamorphoses**). *Arrive at* the fact that **insects** are hatched as living creatures very **unlike the parent.** [insect. *Arrive at* the fact that **insects gradually develop** into the perfect
STAGE II.—Changes during Development.		
(1) **First, or egg stage—**	Questioning.	(1) *Start with* the fact that the **perfect insect** (fly, beetle, or whatever it may be) is the **real parent,** and that the **offspring** at last will be of the **same perfect shape.** *Argue* this by questions.

(*a*) The first **duty of a mother** is to provide for the **feeding** of her **offspring** during helpless **infancy.**	,,	(*a*) *Question out* this duty of **motherhood.** *Ask for* names of **insects well known** for the **care** of their **offspring**, in feeding and nursing them (**bees, wasps, ants**). *Revert* to Lesson on **Butterfly** to show that these **delicate** parents **could not possibly feed** a **host** of ravenous **caterpillars.** *Add* that **many insects die** before their young can be hatched. *Depict* anxious **solicitude of a mother** who knew (as by instinct) her children would be born orphans.
	Telling.	
(*b*) **Instinct guides** the parent, in **depositing her eggs,** to select such **places** as will provide **suitable food at hand** for her newly hatched offspring.	Questioning.	(*b*) *Reason out* that **if food cannot be carried** to the young, the **young must be born** where the **food is in readiness.** *Reason out* that the **food** must be there **in plenty**, too, if the young are **voracious.**
	Telling.	Such **suitable places** are found, (i.) in the ground, (ii.) under bark of trees, (iii.) in putrid meat, (iv.) in many strange places—even in the body of another creature which will be actually devoured.
	Questioning.	*Note* that some (i.) are **vegetable eaters**; (ii.) some **flesh eaters**; (iii.) some **act as scavengers**; (iv.) some are highly **destructive**; but in **every instance** the parent seeks for her eggs— (i.) A secure hiding-place. (ii.) A sufficient supply of food for the offspring.
(*c*) Insects are often provided with **strange forms of egg-placers (ovipositors).**		(*c*) *Argue* that in order to securely place the eggs on such suitable positions, the **tail-end** of insects are **variously formed**—as **saws, boring instruments,** or what not. *Exhibit*, as good examples, drawings of ovipositors of **grass-hopper** and **saw-fly.**
(*d*) The **eggs** are (i.) **very small,** yet contain yolk and white, like bird eggs; (ii.) of **many shapes,** as square, round, pointed, but never oval or true egg-shaped; some are smooth and some ridged in beautiful patterns.	Telling.	(*d*) *Exhibit* available specimens, or enlarged drawings, each properly labelled.

INSECT DEVELOPMENT—*Continued*

Objects and Apparatus.—Pictures of Birds and their Nestlings; Preserved Specimens of Eggs, Larvæ, Pupæ, and Insects mounted in Sets on Cardboard, or Enlarged Drawings of same; Living Insects.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) **Second or Larval Stage**—	Telling.	(2) *Derive* name from L. *larva* = "a mask," and *apply* it to mean that the insect is **masked in this shape.**
(*a*) The young **larvæ** or grubs **bore a hole** in the egg-shell, and eat their way out.		(*a*) *Compare* with **chickens cracking the shells** when they are hatched.
(*b*) Their **business** in life is **to eat**; they **eat many times their own weight**, and **increase in size** rapidly.		(*b*) *Tell* that the larval **period varies** from a few weeks to two years; but **all the growth** is crowded into it.
(*c*) The **skin** is **outgrown**, it **splits** up the back, and is **cast off**; after each moult the **new skin is complete** in every detail, and **larger.**	Questioning.	(*c*) *Infer* the **outgrowing** and **splitting** of the skin, and the **increased size** of each succeeding skin; *also* its **completeness of detail** for hard and soft parts of body alike.
(*d*) **Moults** occur five or six times, during which the grub **hides away** for security.		(*d*) *Infer* **retirement** during the sick period of **moulting—no power to escape** from enemies at such times.
(*e*) **Grubhood** is the **childhood of insects**—	Telling.	(*e*) *Compare* with **our own childhood**; and the alteration in styles of **dress at different periods**, before wearing the dress of "grown-ups."
(i.) **Maggots** with no distinct heads generally produce **flies.**		*Compare* the different **classes of insects** with the different **races of men**—as a black baby growing into a negro.
(ii.) **Grubs**, with head and no legs, or only six legs, generally produce **beetles.**		
(iii.) **Caterpillars**, with a head and six legs, and		

a number of fleshy feet or claspers at the back, produce **moths and butterflies.**

Some larvæ (as of gnats and dragon-flies) spend their lives **in water**, and yet the **perfect insect flies in the air.**

(3) **The Third or Pupal Stage—**

(*a*) The creature has now **arrived at full size**, and seeks a **long retirement.**

(*b*) From the last larval skin it **emerges as a pupa**, with limbs packed close to the body **like a swaddled baby**, having previously **suspended** itself head downwards **by a silken thread.**

(4) **Lastly, the Perfect Insect—**

(*a*) The perfect insect **emerges very weak**, soft, and tender; **legs** scarcely able to support the body; and if with **wings** they are flabby.

(*b*) The perfect insect **never grows.**

(*c*) Many insects **live** but a **very short time.**

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(3) *Derive* name from L. *pupa* = "a baby" or "doll," *apply* it as a reference to being **swaddled.**

(*a*) *Specify* some **hiding-places**: as cocoons, underground, in the bark of trees—**all hide from notice.**

Illustrate by our own habit of **changing dress in privacy.**

(*b*) *Infer* that the pupa is **powerless to move.** (*Exception*—**earwigs** move about and eat, and so **their metamorphosis** is said to be irregular and **incomplete.**)

Remind of **silkworm's threads** spun into a **cocoon.**

Restrict the name **chrysalis** ("golden") to **the pupa of the butterfly**, which is so called because adorned with beautiful gold spots.

(4) *Show how* the **circle of life** is here complete—from parent insect to perfect offspring resembling parent.

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(*a*) *Say* that in **an hour or so**, after exposure to the air, **firmness and strength** come to the new-born creature.

(*b*) *Compare*—a **man never grows**; beetles of different sizes *may be compared* to **horses and ponies.**

Remove such **popular errors**, as the belief that small **flies** grow into bluebottles, or **gnats** into daddy-long-legs.

(*c*) *State* that some **insects never** even **feed**—merely **deposit their eggs**, as the only **business of their lives.**

INSECT DEVELOPMENT—*Continued*

Objects and Apparatus.—Pictures of Birds and their Nestlings ; Preserved Specimens of Eggs, Larvæ, Pupæ, and Insects mounted in Sets on Cardboard, or Enlarged Drawings of same ; Living Insects.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE III.—Recapitulatory, with Added Information.		
Insects are classified in "orders," according to **the form and number of their wings**—	Questioning.	By rapid review, *bring out by questioning* the important points of the Lesson, such as (*a*) **parental care** ; (*b*) selection of **suitable position** for eggs ; (*c*) the **influence of heat** in hatching—and hence maggoty meat in warm weather ; (*d*) contrast between the **delicate sipping** of butterfly and the **greedy voracity** of her caterpillars ; or between **water larvæ** and **aerial insect** of the dragon-fly.
(i.) Sheath-winged (as beetles) ; (ii.) straight-winged (grasshopper, cricket) ; (iii.) nerve-winged (dragon-fly) ; (iv.) membrane-winged (bee) ; (v.) scale-winged (butterfly) ; (vi.) two-winged (fly, gnat) ; (vii.) invisible winged (flea).	Telling.	Then *may be added* the Matter on Classification, as set out.

XXVIII.—STICKLEBACK

Objects and Apparatus.—A Glass Jar of Water containing Living Sticklebacks ; a Piece of Spine Fin cut from a Perch or a Mackerel, and a Piece of Soft Fin cut from a Plaice or other Flat Fish ; Picture of Stickleback's Nest.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Stickleback.		
(1) The stickleback is a **well-known small fish** to be found in almost any pond or stream.	Observation.	(1) *Ask* the **name**—stickleback or tittlebat generally—local names various. *Ask* **where** such are **to be seen**, and easily caught.

(2) It is about one and a half inches in length; **some** specimens are of a **dull colour**, while **others** are **brilliant** in shining colours.

(3) It has **spiny fins**.

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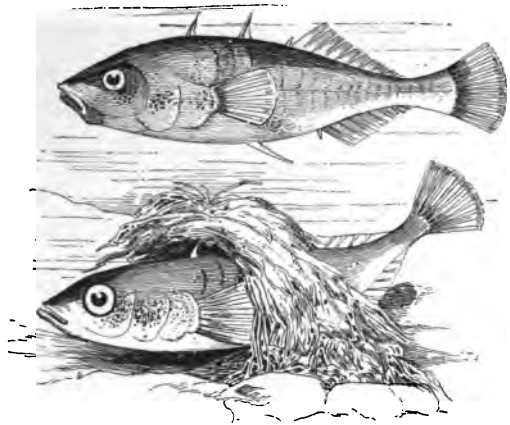
(2) *Let scholars* **measure** approximate **length** along their fingers.
Have the **sober colourings** *named*—grey and brown.
Have the more **gorgeous colourings** *described*—flashings of crimson, green, and gold.

(3) *Pass round* a **dead stickleback** for spines to be felt.
Compare **soft fins** with **spine fins** by passing round labelled specimens of each; and have the thorny rays of the former felt.



The Three-spined Stickleback and Nest.

(4) In one (of the seven British) species, the **back** (or **dorsal**) fin consists only of **three sharp, strong rays**, with no skin (or **membrane**) joining them together.
The **belly** (or **ventral**) fin is reduced to **a single ray**, equally strong.

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(4) *Mark* the **appropriateness** of the name for this species—"**the three-spined stickleback**."
Connect **name** "stickleback" with the **nature** of these "thorny spines" on the "back."
Observe that not only are these **three spines** unusually strong, but that they **stand out without** any **joining membrane** which usually forms a fin.

STICKLEBACK—*Continued*

Objects and Apparatus.—A Glass Jar of Water containing Living Sticklebacks; a Piece of Spine Fin cut from a Perch or a Mackerel, and a Piece of Soft Fin cut from a Plaice or other Flat Fish; Picture of Stickleback's Nest.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE II.—Structure and Habit.		
(1) The stickleback belongs to the **spine-finned** fishes.	Questioning.	(1) **How** does the nature of **some fins differ** from the nature of others?—(Some soft, some spiny.) To **which class** does the **stickleback** belong?—(Spine finned.) *Name* others of each class.
(2) Its **spines** are remarkably **strong and sharp.**	,,	(2) What does the **name** stickleback **mean?**—(Thorny or spiny back.) For so small a fish, would you call the **spines strong or weak?**—(Strong.)
(3) These spines are its **weapons.** It is a **brave** little fish, and rather **fond of fighting.**	,,	(3) Why have you to be **careful in handling** a stickleback?—(Its spike-like fins **hurt.**) Of **what use** are these dangerous-looking **spikes** to the little fish?—(**Weapons.**) **Armed** so well, and being active and **lively,** may we expect it to be **timid or courageous?**—(Courageous.) If we put our **finger** or a **stick** in the water, what will the stickleback sometimes do?—(**Attack** it.)
(4) The **brilliantly coloured** fishes are the **males.**	Telling.	(4) *Compare* with **birds,** among whom the **male** has often the **more brilliant** plumage. *State* that for nine or ten months of the year **both sexes** are very much **alike,** and it is only in the **breeding season,** from April to June, that the **male assumes his gorgeous apparel.**
STAGE III.—Breeding and Rearing.		
(1) At the breeding season the **male** stickleback **builds a nest.**	Questioning. Telling.	(1) **What creatures** build **nests** in which to lay their **eggs?**—(Birds.) Among birds, is it the **male or the female** which usually attends to the **nest and the young?**—(The female.) *Proceed to show* the **great peculiarity** of habit which characterises

(*a*) **Vegetable fibre** is twined in and out, and the **shape** of the nest is like **a barrel** with both ends knocked out.

(*b*) In a muddy stream the nest is **built in the mud**; but in a clear stream the nest is **fixed in reeds, or roots** of water-side plants.

(2) **When the nest** or house is **complete**, the male stickleback **brings his mate** to it; she enters, her head protruding at one end, and her tail at the other, and **after laying four eggs, goes away.**

(3) The **male** fish then **mounts guard** over the nest and its **eggs**, allowing no living creature to approach within a certain distance of his home.

(4) When the eggs are hatched, the **young are so tiny and transparent** it is impossible to see them at first.

(5) The male parent **continues** his careful **guard over the young**—

(*a*) At first he will **not allow** any of them **to leave** the nest.

(*b*) When a little older and stronger, he **allows** them to swim **only in the area** under guard.

(*c*) Should one **break bounds**, the watchful parent darts after it, catches it in his mouth, and **makes a prisoner of it** in the nest.

The **female does nothing** but attempt to break into the nest and **eat the eggs.**

the stickleback—(i.) It is a **fish** which **builds a nest,** (ii.) it is the **male fish** which **attends the young.**

(*a*)
(*b*) } *Exhibit* picture of **stickleback's nest.**

Telling. (2) *Describe* the **eggs** as like very **small shot.**
Tell that this is done with a **succession of mates** till a number of eggs have been deposited.

" (3) *Describe* the creature's **fussiness** and undaunted **courage** in attacking all trespassers.

" (4) *Say* that those hatched under observation in an aquarium have **only** been **discerned by means of their eyes.**

" (5) *Compare* his fussiness with the maternal solicitude of "**a hen with one chick.**"

Impart this information.
Then show how the stickleback **reverses** the **ordinary** ways of **nature**—

(i.) **Fishes**, as a rule, take **no care of their offspring**—lay the eggs and leave them.

(ii.) It is **generally the female** which undertakes all the **parental care.**

(iii.) Among some wild creatures it is the **mother** who **hides her young from her mate** to prevent him devouring them.

Objects and Apparatus.—A Glass Jar of Water containing Living Sticklebacks ; a Piece of Spine Fin cut from a Perch or a Mackerel, and a Piece of Soft Fin cut from a Plaice or other Flat Fish ; Picture of Stickleback's Nest.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(6) When a **rival** stickleback **trespasses** in the forbidden area, a **fierce combat** ensues; after a short battle the **vanquished one flees, and loses his brilliancy,** while the victor's hue blazes with double splendour.	Telling.	(6) *Describe* the **combat** as like the gripping of two bull-dogs, the antagonists **whirling round** so fast that it is impossible to distinguish them ; the **spines are erected,** and they try to rip each other's sides. *Depict* the **conqueror** as **gleaming** with vivid crimson underneath, the body olive mottled with other hues, and eyes as if made of emeralds ; while the **defeated** one retires to the **sober grey and brown** of ordinary life.
STAGE IV.—Recapitulation and Additional Information.	Questioning.	By recapitulatory questioning *review the main points* of the Lesson— *Bring out* the interesting characteristics of the male stickleback— (i.) He alone attains **brilliancy** of colouring (ii.) ,, takes charge of **family arrangements** ,, **builds the nest** ,, **watches** over it and fights for it ,, rears and **educates the offspring** } while the **female** takes **no interest** beyond trying to devour the eggs.
Sticklebacks are not so easy to keep alive as **pets in confinement,** as are gold or silver fish.	Telling.	Offer following advice **for keeping fishes** in a glass globe— (i.) The **water** should be **changed often**—for plenty of fresh air. (ii.) It should be **kept fresh by water-plants** (brook lime, water-violets, &c.). (iii.) A water-snail might be kept in it to **eat up decayed vegetation.** [mud. (iv.) **Clean shingle** on the bottom, and no slimy } Keep water sweet and pure. (v.) **Prevention of direct sunlight** through the sides, as fishes cannot close their eyes to exclude a glare.

XXIX.—LOCOMOTION

Objects and Apparatus.—Pictures of Quadrupeds, Birds, Fishes, more particularly those named in the Notes.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Why Animals want to move from place to place.		
		Educe the whole of this **introduction** by some such series of questions as the following—
(1) **Animal life** constantly requires **food** for its support.	Questioning.	(1) What do **all living** plants and animals **constantly require?**—(Air and food.) **Where** is the **air** found?—(**Everywhere** around us.) **Where** is the **food of plants** found?—(In the **air** and in the **soil**.)
(2) This **food** is of various kinds, **scattered** in various parts.	,,	(2) **Where** is the **food** of **animals** found?—Various places—**scattered.**) **Which kind of life**, animal life or plant life, can **find** its **food** when rooted to **one spot?**—(Plant life.)
(3) Therefore **animals** must be **able to move about** in search of food.	,,	(3) And **which must move** about in search of food?—(Animal life.) **How** do **we** move about?—(**On legs.**) **How** do **birds** move?—(**Wings.**) **How** do **fishes** move?—(**Fins.**)
STAGE II.—The Limbs of Mammals.		
(1) Most of the **mammals** have **four limbs.**	Questioning.	(1) *Name* some mammals, or **animals which suckle** their young, as we are suckled when **babes?**—(Horse, dog.) **How many limbs** (or legs) have they?—(Four.) **How many legs** has a **man?**—(Two.) How many **limbs** have we?—(Four.) **What** do we **call** the **front pair** of limbs?—(**Arms.**)
(2) **Man** has **four limbs**, but **walks upright** on the hind pair only.	,,	(2) **When a dog walks** on his four legs, **which way** is his **backbone**, upright (vertical) or **lying along** (horizontal) the same way as the ground?—(Horizontal.) But when a **man walks** on his two legs, **which way** is his **backbone** directed?—(Vertically.) **How** could we **imitate the attitude** of a dog, in the number of **legs** and the line of the **backbone?**—(On **all fours.**)

LOCOMOTION—*Continued*

Objects and Apparatus.—Pictures of Quadrupeds, Birds, Fishes, more particularly those named in the Notes.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		Elaborate this point of **general correspondence** in the limbs of **biped man** and the **quadruped** mammals. *Let class name* the **corresponding parts** on the **fore and hind limbs** of a man; as **toes** and fingers, **foot** and hand, **sole** and palm, **ankle** and wrist, **knee** and elbow, **thigh** and shoulder, &c. *Class to name* some **varieties** of the **modified forms of feet**; as paws, hoofs, solid and cloven.
(3) The **legs and feet** of mammals often take **special forms** to **fit** their **habits** of life; as—	Telling.	(3) *Lay down* as the great and **primary function** of limbs, **locomotion**. *Admit* that the **locomotion of animals** will be found very **variable** in its kind.
	Questioning.	*Elicit* by questions the **chief modes of progression**, beside walking and running—flying, &c.
(*a*) **Walking** and running are the ordinary modes of progression.		(*a*) *Question* on **sole-walkers** (man, bear) and **toe-walkers** (dogs, horses); and on "**silent walkers**" approaching with "cat-like tread," and **solid hoofed** beasts suited to heavy **draught on hard roads.**
(*b*) **Climbing.**	,,	(*b*) *Question* on **squirrels** whose bodies are light, legs are short, and nails changed to long **sharp curved claws.** *Question* on **rats**, whose **hind feet** will turn right round at the ankle, and claws **point backwards** for climbing. *Ask* where **monkeys** spend **most** of their **lives?**—(In trees.) **Which** do we **use most in climbing**, our hands or our feet?—(Hands.) **Which** will **best suit** a climbing life, four feet or **four hands?**—(Four hands.)
	Telling.	*Name* monkeys the **four-handed animals**; *contrast* with **sloth**, which always hangs head down, underneath the branches (upon the leaves of which it feeds) by **strong hooked claws.**

(*c*) **Flying.**	Questioning.	(*c*) *By questioning revert* to lesson on **"the bat,"** whose **wings** have skeletons **corresponding** to the bones in our **arms and fingers.** *Name* it **"hand-winged."**
(*d*) **Swimming.**	Telling. ,,	(*d*) *Remind* that the **whale** is a warm-blooded **animal** with the **shape of a fish.** *Tell* that the fore limbs or **fins** are used for **balancing** or **holding the young** during suckling; and that the **hind limbs are absent,** while the **broad tail-fin** placed at **right angles** to the body is the **organ of locomotion.** *Tell* that **seals** have four limbs, or **flippers,** with **web-feet**; call them **"fin walkers."** *Tell that* **otter, beaver,** and **polar bear** have hind feet flat and expanded, and **toes webbed.**
(*e*) **Burrowing.**	,,	(*e*) *Instance* the **mole,** whose paws are **digging tools** like spade and pick combined.
(*f*) **Jumping.**	,,	(*f*) *Instance* the **kangaroo,** in which the **hind limbs** are enlarged and **strengthened**; *contrasting* with the **mole's** strong fore-limbs.

STAGE III.—The Flight of Birds.		
(1) **Birds** have four limbs, but the **fore limbs** are **wings.**	Telling.	(1) *Flap* the **arms like wings**; *demonstrate* the **correspondence** between arms and wings. *Note* that birds, like ourselves, are **bipeds.**
(2) The **more** birds **use their wings,** the **more powerful** these limbs become.	,,	(2) *Name* birds of **strong flight** (eagle, swallow); of **weak flight** (ducks, fowl); **no flight** (ostrich). *Teach* that nature **gradually abandons** that which **ceases to be used**; and *quote* **weak legs** of swallows, and **useless wings** of ostriches; *and the converse,* that what is constantly in **use develops strength,** and *quote* strong **arms** of a **blacksmith.**
(3) Birds are **constructed of special lightness,** for rising in the air.	Questioning.	(3) *Let class enumerate* the points of special construction in birds— (*a*) **Bones** light and mostly hollow. (*b*) **Power** to fill the body with **light warm air.** (*c*) **Feathers** the lightest and warmest possible covering.
(4) Birds **need to cover great distances** in their search for **food**—some **migrate** to far-off lands at certain **seasons.**	,,	(4) *Allude briefly* to the **kinds of food** sought; and to **birds of passage.** *Allude briefly* to the now ascertained **universal movement** of all birds from **higher and lower latitudes** to escape **severity** of cold season.

XXVII.—INSECT DEVELOPMENT

Objects and Apparatus.—Pictures of Birds and their Nestlings ; Preserved Specimens of Eggs, Larvæ, Pupæ, and Insects mounted in Sets on Cardboard, or Enlarged Drawings of same ; Living Insects.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Introduction.		
(1) **Some creatures lay eggs,** from which their young are produced.	Questioning.	(1) *Question* on the laying and hatching of **birds' eggs.** *Ask* what **other creatures** lay eggs. *Collect* the answers (**fishes, frogs, insects**). *Arrive* at the fact that the **young produced from eggs** are those of— (*a*) **All birds, soft-bodied animals** (such as oysters) and **jointed animals** (such as crabs). (*b*) **Most fishes** and **reptiles.**
(2) **Insects are produced from eggs,** but go through **several changes afterwards,** before becoming perfect.	,,	(2) *Include* **insects** among the **jointed animals,** *after questioning* on their jointed **segmented bodies,** and their **jointed limbs.**
(3) The **changes** or transformation are **generally three** ; these are— (*a*) The egg stage. (*b*) The larval or grub stage. (*c*) The pupal stage— before maturity.	,,	(3) *By questioning discover* that **chickens** are hatched fluffy, but **strong** and **resembling parent** birds. *By questioning discover* that **many birds** are hatched **naked** and **helpless,** but with all the **parents' features.** *Contrast* **insects**—*exhibit,* by specimens or drawings, the **stages of development** ; and *name* them (*note* that there are **incomplete** changes or **metamorphoses**). *Arrive at* the fact that **insects** are hatched as living creatures very **unlike the parent.** [insect. *Arrive at* the fact that **insects gradually develop** into the perfect
STAGE II.—Changes during Development.		
(1) **First, or egg stage—**	Questioning.	(1) *Start with* the fact that the **perfect insect** (fly, beetle, or whatever it may be) is the **real parent,** and that the **offspring** at last will be of the **same perfect shape.** *Argue* this by questions.

(*a*) The first **duty of a mother** is to provide for the **feeding** of her **offspring** during helpless **infancy.**	,,	(*a*) *Question out* this duty of **motherhood.** *Ask for* names of **insects well known** for the **care** of their **offspring**, in feeding and nursing them (**bees, wasps, ants**). *Revert* to Lesson on **Butterfly** to show that these **delicate** parents **could not possibly feed** a **host** of ravenous **caterpillars.** *Add* that **many insects die** before their young can be hatched. *Depict* anxious **solicitude of a mother** who knew (as by instinct) her children would be born orphans.
	Telling.	
(*b*) **Instinct guides** the parent, in **depositing her eggs,** to select such **places** as will provide **suitable food at hand** for her newly hatched offspring.	Questioning.	(*b*) *Reason out* that **if food cannot be carried** to the young, the **young must be born** where the **food is in readiness.** *Reason out* that the **food** must be there **in plenty**, too, if the young are **voracious.**
	Telling.	Such **suitable places** are found, (i.) in the ground, (ii.) under bark of trees, (iii.) in putrid meat, (iv.) in many strange places—even in the body of another creature which will be actually devoured.
	Questioning.	*Note* that some (i.) are **vegetable eaters**; (ii.) some **flesh eaters**; (iii.) some **act as scavengers**; (iv.) some are highly **destructive**; but in **every instance** the parent seeks for her eggs— (i.) A secure **hiding-place.** (ii.) A sufficient **supply of food** for the offspring.
(*c*) Insects are often provided with **strange forms of egg-placers (ovipositors).**		(*c*) *Argue* that in order to securely place the eggs on such suitable positions, the **tail-end** of insects are **variously formed**—as **saws, boring instruments,** or what not. *Exhibit*, as good examples, drawings of ovipositors of **grass-hopper** and **saw-fly.**
(*d*) The **eggs** are (i.) **very small,** yet contain yolk and white, like bird eggs; (ii.) of **many shapes,** as square, round, pointed, but never oval or true egg-shaped; some are smooth and some ridged in beautiful patterns.	Telling.	(*d*) *Exhibit* available specimens, or enlarged drawings, each properly labelled.

INSECT DEVELOPMENT—*Continued*

Objects and Apparatus.—Pictures of Birds and their Nestlings; Preserved Specimens of Eggs, Larvæ, Pupæ, and Insects mounted in Sets on Cardboard, or Enlarged Drawings of same; Living Insects.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) **Second or Larval Stage**—	Telling.	(2) *Derive* name from L. *larva* = "a mask," and *apply* it to mean that the insect is **masked in this shape.**
(*a*) The young **larvæ** or grubs **bore a hole** in the egg-shell, and eat their way out.		(*a*) *Compare* with **chickens cracking the shells** when they are hatched.
(*b*) Their **business** in life is **to eat**; they **eat many times their own weight**, and **increase in size** rapidly.		(*b*) *Tell* that the larval **period varies** from a few weeks to two years; but **all the growth** is crowded into it.
(*c*) The **skin** is **outgrown**, it **splits** up the back, and is **cast off**; after each moult the **new skin is complete** in every detail, and **larger.**	Questioning.	(*c*) *Infer* the **outgrowing** and **splitting** of the skin, and the **increased size** of each succeeding skin; *also* its **completeness of detail** for hard and soft parts of body alike.
(*d*) **Moults** occur five or six times, during which the grub **hides away** for security.		(*d*) *Infer* **retirement** during the sick period of **moulting—no power to escape** from enemies at such times.
(*e*) **Grubhood** is the **childhood of insects**—	Telling.	(*e*) *Compare* with **our own childhood**; and the alteration in styles of **dress at different periods,** before wearing the dress of "grown-ups."
(i.) **Maggots** with no distinct heads generally produce **flies.**		*Compare* the different **classes of insects** with the different **races of men**—as a black baby growing into a negro.
(ii.) **Grubs,** with head and no legs, or only six legs, generally produce **beetles.**		
(iii.) **Caterpillars,** with a head and six legs, and		

a number of fleshy feet or claspers at the back, produce **moths and butterflies.**

Some larvæ (as of gnats and dragon-flies) spend their lives **in water,** and yet the **perfect insect flies in the air.**

(3) **The Third or Pupal Stage—**

(*a*) The creature has now **arrived at full size,** and seeks a **long retirement.**

(*b*) From the last larval skin it **emerges as a pupa,** with limbs packed close to the body **like a swaddled baby,** having previously **suspended** itself head downwards **by a silken thread.**

(4) **Lastly, the Perfect Insect—**

(*a*) The perfect insect **emerges very weak,** soft, and tender; **legs** scarcely able to support the body; and if with **wings** they are flabby.

(*b*) The perfect insect **never grows.**

(*c*) Many insects **live** but a **very short time.**

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(3) *Derive* name from L. *pupa*="a baby" or "doll," *apply* it as a reference to being **swaddled.**

(*a*) *Specify* some **hiding-places:** as cocoons, underground, in the bark of trees—**all hide from notice.**

Illustrate by our own habit of **changing dress in privacy.**

(*b*) *Infer* that the pupa is **powerless to move.** (*Exception*—**earwigs** move about and eat, and so **their metamorphosis** is said to be irregular and **incomplete.**)

Remind of **silkworm's threads** spun into a **cocoon.**

Restrict the name **chrysalis** ("golden") to **the pupa of the butterfly,** which is so called because adorned with beautiful gold spots.

(4) *Show how* the **circle of life** is here complete—from parent insect to perfect offspring resembling parent.

(*a*) *Say* that in **an hour or so,** after exposure to the air, **firmness and strength** come to the new-born creature.

(*b*) *Compare*—a **man never grows;** beetles of different sizes *may be compared* to **horses and ponies.**

Remove such **popular errors,** as the belief that small **flies** grow into bluebottles, or **gnats** into daddy-long-legs.

(*c*) *State* that some **insects never** even **feed**—merely **deposit their eggs,** as the only **business of their lives.**

INSECT DEVELOPMENT—*Continued*

Objects and Apparatus.—Pictures of Birds and their Nestlings; Preserved Specimens of Eggs, Larvæ, Pupæ, and Insects mounted in Sets on Cardboard, or Enlarged Drawings of same; Living Insects.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE III.—Recapitulatory, with Added Information.		
Insects are classified in "orders," according to **the form and number of their wings**—	Questioning.	By rapid review, *bring out by questioning* the important points of the Lesson, such as (*a*) **parental care**; (*b*) selection of **suitable position** for eggs; (*c*) the **influence of heat** in hatching—and hence maggoty meat in warm weather; (*d*) contrast between the **delicate sipping** of butterfly and the **greedy voracity** of her caterpillars; or between **water larvæ** and **aerial insect** of the dragon-fly.
(i.) Sheath-winged (as beetles); (ii.) straight-winged (grasshopper, cricket); (iii.) nerve-winged (dragon-fly); (iv.) membrane-winged (bee); (v.) scale-winged (butterfly); (vi.) two-winged (fly, gnat); (vii.) invisible winged (flea).	Telling.	Then *may be added* the Matter on Classification, as set out.

XXVIII.—STICKLEBACK

Objects and Apparatus.—A Glass Jar of Water containing Living Sticklebacks; a Piece of Spine Fin cut from a Perch or a Mackerel, and a Piece of Soft Fin cut from a Plaice or other Flat Fish; Picture of Stickleback's Nest.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Stickleback.		
(1) The stickleback is a **well-known small fish** to be found in almost any pond or stream.	Observation.	(1) *Ask* the **name**—stickleback or tittlebat generally—local names various. *Ask* **where** such are **to be seen**, and easily caught.

(2) It is about one and a half inches in length; **some** specimens are of a **dull colour**, while **others** are **brilliant** in shining colours.

(3) It has **spiny fins**.

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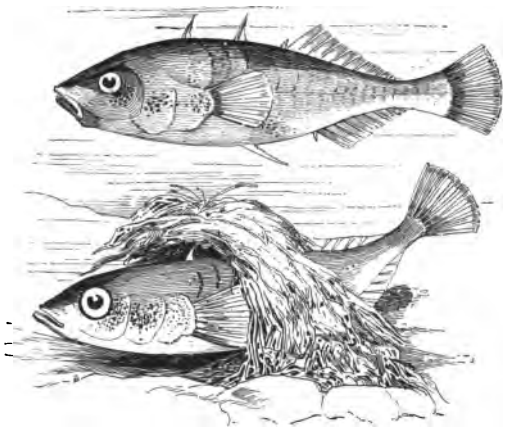
(2) *Let scholars* **measure** approximate **length** along their fingers.
Have the **sober colourings** *named*—grey and brown.
Have the more **gorgeous colourings** *described*—flashings of crimson, green, and gold.

(3) *Pass round* a **dead stickleback** for spines to be felt.
Compare **soft fins** with **spine fins** by passing round labelled specimens of each; and have the thorny rays of the former felt.



The Three-spined Stickleback and Nest.

(4) In one (of the seven British) species, the **back** (or **dorsal**) fin consists only of **three sharp, strong rays**, with no skin (or **membrane**) joining them together.
The **belly** (or **ventral**) fin is reduced to **a single ray**, equally strong.

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(4) *Mark* the **appropriateness** of the name for this species—"**the three-spined stickleback**."
Connect **name** "stickleback" with the **nature** of these "thorny spines" on the "back."
Observe that not only are these **three spines** unusually strong, but that they **stand out without** any **joining membrane** which usually forms a fin.

STICKLEBACK—*Continued*

Objects and Apparatus.—A Glass Jar of Water containing Living Sticklebacks; a Piece of Spine Fin cut from a Perch or a Mackerel, and a Piece of Soft Fin cut from a Plaice or other Flat Fish; Picture of Stickleback's Nest.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE II.—Structure and Habit.		
(1) The stickleback belongs to the **spine-finned** fishes.	Questioning.	(1) **How** does the nature of **some fins differ** from the nature of others?—(Some soft, some spiny.) To **which class** does the **stickleback** belong?—(Spine finned.) *Name* others of each class.
(2) Its **spines** are remarkably **strong and sharp.**	,,	(2) What does the **name** stickleback **mean?**—(Thorny or spiny back.) For so small a fish, would you call the **spines strong or weak?**—(Strong.)
(3) These spines are its **weapons.** It is a **brave** little fish, and rather **fond of fighting.**	,,	(3) Why have you to be **careful in handling** a stickleback?—(Its spike-like fins **hurt.**) Of **what use** are these dangerous-looking **spikes** to the little fish?—(**Weapons.**) **Armed** so well, and being active and **lively,** may we expect it to be **timid or courageous?**—(Courageous.) If we put our **finger** or a **stick** in the water, what will the stickleback sometimes do?—(**Attack** it.)
(4) The **brilliantly coloured** fishes are the **males.**	Telling.	(4) *Compare* with **birds,** among whom the **male** has often the **more brilliant** plumage. *State* that for nine or ten months of the year **both sexes** are very much **alike,** and it is only in the **breeding season,** from April to June, that the **male assumes his gorgeous apparel.**
STAGE III.—Breeding and Rearing.		
(1) At the breeding season the **male** stickleback **builds a nest.**	Questioning. Telling.	(1) **What creatures** build **nests** in which to lay their **eggs?**—(Birds.) Among birds, is it the **male or the female** which usually attends to the **nest and the young?**—(The female.) *Proceed to show* the **great peculiarity** of habit which characterises

(*a*) **Vegetable fibre** is twined in and out, and the **shape** of the nest is like **a barrel** with both ends knocked out. (*b*) In a muddy stream the nest is **built in the mud**; but in a clear stream the nest is **fixed in reeds, or roots** of water-side plants.	the stickleback—(i.) It is a **fish** which **builds a nest,** (ii.) it is the **male fish** which **attends the young.** (*a*) (*b*) *Exhibit* picture of **stickleback's nest.**
(2) **When the nest** or house is **complete,** the male stickleback **brings his mate** to it; she enters, her head protruding at one end, and her tail at the other, and **after laying four eggs, goes away.**	Telling. (2) *Describe* the **eggs** as like very **small shot.** *Tell* that this is done with a **succession of mates** till a number of eggs have been deposited.
(3) The **male** fish then **mounts guard** over the nest and its **eggs,** allowing no living creature to approach within a certain distance of his home.	,, (3) *Describe* the creature's **fussiness** and undaunted **courage** in attacking all trespassers.
(4) When the eggs are hatched, the **young are so tiny and transparent** it is impossible to see them at first.	,, (4) *Say* that those hatched under observation in an aquarium have **only** been **discerned by means of their eyes.**
(5) The male parent **continues** his careful **guard over the young**— (*a*) At first he will **not allow** any of them **to leave** the nest. (*b*) When a little older and stronger, he **allows** them to swim **only in the area** under guard. (*c*) Should one **break bounds,** the watchful parent darts after it, catches it in his mouth, and **makes a prisoner of it** in the nest. The **female does nothing** but attempt to break into the nest and **eat the eggs.**	,, (5) *Compare* his fussiness with the maternal solicitude of "**a hen with one chick.**" *Impart* this information. *Then show* how the stickleback **reverses** the **ordinary** ways of **nature**— (i.) **Fishes,** as a rule, take **no care of their offspring**—lay the eggs and leave them. (ii.) It is **generally the female** which undertakes all the **parental care.** (iii.) Among some wild creatures it is the **mother** who **hides her young from her mate** to prevent him devouring them.

STICKLEBACK—*Continued*

Objects and Apparatus.—A Glass Jar of Water containing Living Sticklebacks ; a Piece of Spine Fin cut from a Perch or a Mackerel, and a Piece of Soft Fin cut from a Plaice or other Flat Fish ; Picture of Stickleback's Nest.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(6) When a **rival** stickleback **trespasses** in the forbidden area, a **fierce combat** ensues; after a short battle the vanquished one **flees, and loses his brilliancy,** while the victor's hue blazes with double splendour.	Telling.	(6) *Describe* the **combat** as like the gripping of two bull-dogs, the antagonists **whirling round** so fast that it is impossible to distinguish them ; the **spines are erected,** and they try to rip each other's sides. *Depict* the **conqueror** as **gleaming** with vivid crimson underneath, the body olive mottled with other hues, and eyes as if made of emeralds ; while the **defeated** one retires to the **sober grey and brown** of ordinary life.
STAGE IV.—Recapitulation and Additional Information.	Questioning.	By recapitulatory questioning *review the main points* of the Lesson— *Bring out* the interesting characteristics of the male stickleback— (i.) He alone attains **brilliancy** of colouring (ii.) ,, takes charge of **family arrangements** / ,, **builds the nest** / ,, **watches** over it and fights for it / ,, rears and **educates the offspring** } while the **female** takes **no interest** beyond trying to devour the eggs.
Sticklebacks are not so easy to keep alive as **pets in confinement,** as are gold or silver fish.	Telling.	Offer following advice for keeping **fishes** in a glass globe— (i.) The **water** should be **changed often**—for plenty of fresh air. (ii.) It should be **kept fresh by water-plants** (brook lime, water-violets, &c.). (iii.) A water-snail might be kept in it to **eat up decayed vegetation.** [mud. } Keep water sweet and pure. (iv.) **Clean shingle** on the bottom, and no slimy (v.) **Prevention of direct sunlight** through the sides, as fishes cannot close their eyes to exclude a glare.

XXIX.—LOCOMOTION

Objects and Apparatus.—Pictures of Quadrupeds, Birds, Fishes, more particularly those named in the Notes.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Why Animals want to move from place to place.		
		Educe the whole of this **introduction** by some such series of questions as the following—
(1) **Animal life** constantly requires **food** for its support.	Questioning.	(1) What do **all living** plants and animals **constantly require?**—(Air and food.) **Where** is the **air** found?—(**Everywhere** around us.) **Where** is the **food of plants** found?—(In the **air** and in the **soil**.)
(2) This **food** is of various kinds, **scattered** in various parts.	,,	(2) **Where** is the **food** of **animals** found?—Various places—**scattered.**) **Which kind of life,** animal life or plant life, can **find** its **food** when rooted to **one spot?**—(Plant life.)
(3) Therefore **animals** must be **able to move about** in search of food.	,,	(3) And **which must move** about in search of food?—(Animal life.) **How** do **we** move about?—(**On legs.**) **How** do **birds** move?—(**Wings.**) **How** do **fishes** move?—(**Fins.**)
STAGE II.—The Limbs of Mammals.		
(1) Most of the **mammals** have **four limbs.**	Questioning.	(1) *Name* some mammals, or **animals which suckle** their young, as we are suckled when **babes?**—(Horse, dog.) **How many limbs** (or legs) have they?—(Four.) **How many legs** has a **man?**—(Two.) How many **limbs** have we?—(Four.) **What** do we **call** the **front pair** of limbs?—(**Arms.**)
(2) **Man** has **four limbs,** but **walks upright** on the hind pair only.	,,	(2) **When a dog walks** on his four legs, **which way** is his **backbone,** upright (vertical) or **lying along** (horizontal) the same way as the ground?—(Horizontal.) But when a **man walks** on his two legs, **which way** is his **backbone** directed?—(Vertically.) **How** could we **imitate the attitude** of a dog, in the number of **legs** and the line of the **backbone?**—(On **all fours.**)

LOCOMOTION—*Continued*

Objects and Apparatus.—Pictures of Quadrupeds, Birds, Fishes, more particularly those named in the Notes.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		Elaborate this point of **general correspondence** in the limbs of **biped man** and the **quadruped** mammals.
		Let class name the **corresponding parts** on the **fore and hind limbs** of a man; as **toes** and fingers, **foot** and hand, **sole** and palm, **ankle** and wrist, **knee** and elbow, **thigh** and shoulder, &c.
		Class to name some **varieties** of the **modified forms of feet**; as paws, hoofs, solid and cloven.
(3) The **legs and feet** of mammals often take **special forms** to **fit** their **habits** of life; as—	Telling.	(3) *Lay down* as the great and **primary function** of limbs, **locomotion**.
		Admit that the **locomotion of animals** will be found very **variable** in its kind.
	Questioning.	*Elicit* by questions the **chief modes of progression**, beside walking and running—flying, &c.
(*a*) **Walking** and running are the ordinary modes of progression.		(*a*) *Question* on **sole-walkers** (man, bear) and **toe-walkers** (dogs, horses); and on "**silent walkers**" approaching with "cat-like tread," and **solid hoofed** beasts suited to heavy **draught on hard roads**.
(*b*) **Climbing**.	,,	(*b*) *Question* on **squirrels** whose bodies are light, legs are short, and nails changed to long **sharp curved claws**.
		Question on **rats**, whose **hind feet** will turn right round at the ankle, and claws **point backwards** for climbing.
		Ask where **monkeys** spend **most** of their **lives?**—(In trees.) **Which** do we **use most in climbing**, our hands or our feet?—(Hands.) **Which** will **best suit** a climbing life, four feet or **four hands?**—(Four hands.)
	Telling.	*Name* monkeys the **four-handed animals**; *contrast* with **sloth**, which always hangs head down, underneath the branches (upon the leaves of which it feeds) by **strong hooked claws**.

(*c*) **Flying.**	Questioning.	(*c*) *By questioning revert* to lesson on **"the bat,"** whose **wings** have skeletons **corresponding** to the bones in our **arms and fingers**. *Name* it **"hand-winged."**
(*d*) **Swimming.**	Telling. ,,	(*d*) *Remind* that the **whale** is a warm-blooded **animal** with the **shape of a fish**. *Tell* that the fore limbs or **fins** are used for **balancing** or **holding the young** during suckling; and that the **hind limbs are absent**, while the **broad tail-fin** placed at **right angles** to the body is the **organ of locomotion**. *Tell* that **seals** have four limbs, or **flippers**, with **web-feet**; call them **"fin walkers."** *Tell that* **otter, beaver,** and **polar bear** have hind feet flat and expanded, and **toes webbed.**
(*e*) **Burrowing.**	,,	(*e*) *Instance* the **mole**, whose paws are **digging tools** like spade and pick combined.
(*f*) **Jumping.**	,,	(*f*) *Instance* the **kangaroo**, in which the **hind limbs** are enlarged and **strengthened**; *contrasting* with the **mole's** strong fore-limbs.

STAGE III.—The Flight of Birds.		
(1) **Birds** have four limbs, but the **fore limbs** are **wings.**	Telling.	(1) *Flap* the **arms like wings**; *demonstrate* the **correspondence** between arms and wings. *Note* that birds, like ourselves, are **bipeds.**
(2) The **more** birds **use their wings,** the **more powerful** these limbs become.	,,	(2) *Name* birds of **strong flight** (eagle, swallow); of **weak flight** (ducks, fowl); **no flight** (ostrich). *Teach* that nature **gradually abandons** that which **ceases to be used**; and *quote* **weak legs** of swallows, and **useless wings** of ostriches; *and the converse,* that what is constantly in **use develops strength**, and *quote* strong **arms** of a **blacksmith.**
(3) Birds are **constructed of special lightness,** for rising in the air.	Questioning.	(3) *Let class enumerate* the points of special construction in birds— (*a*) **Bones** light and mostly hollow. (*b*) **Power** to fill the body with **light warm air.** (*c*) **Feathers** the lightest and warmest possible covering.
(4) Birds **need to cover great distances** in their search for **food**—some **migrate** to far-off lands at certain **seasons.**	,,	(4) *Allude briefly* to the **kinds of food** sought; and to **birds of passage.** *Allude briefly* to the now ascertained **universal movement** of all birds from **higher and lower latitudes** to escape **severity** of cold season.

LOCOMOTION—*Continued*

Objects and Apparatus.—Pictures of Quadrupeds, Birds, Fishes, more particularly those named in the Notes.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE IV.—How Fishes Swim.		
(1) A fish has **fins** to move through the water.	Telling.	(1) *Correct* to the statement that **fins are really balancers**, and the **propelling** is done by the **tail.** *Illustrate* by the sculling of a **boat**—the single **oar** is moved first one way and then another **out of the stern.**
(2) Sometimes the **fins correspond** with the **four limbs of mammals.**	,,	(2) *Teacher points out* a **fish** in which are **present**— (*a*) Pair of **breast fins** (*pectoral*) just behind the gills, which correspond to **arms and wings.** (*b*) Pair of **belly fins** (*ventral*), sometimes forward, sometimes backward, which correspond to **hind legs.** *Tell* that most **fish**, bulk for bulk, are the **same weight as the water**; *infer* that they move easily in the water; and further, that those possessing an **air-bladder**, rise by enlarging it, and sink by making it smaller. *Illustrate* by blowing up a child's toy **balloon.**
STAGE V.—Recapitulation and Additional Information.	Questioning.	Recapitulate to review chief points. Then *add*—
(1) Frogs and toads belong to the "**jumpers**" (*Salientia*).		(1) *Make passing allusions* only—*Compare* with strong **hind-quarters** of a rabbit.
(2) **Snakes** walk without legs, climb without hands, swim without fins.		(2) *Make passing allusions* only—*Describe* long **pliant bodies** which crawl and wriggle along.
(3) Insects have six **legs** and often four wings. **Spiders** have eight legs. **Centipedes** have many legs.		(3) *Make passing allusions* only—*Count* **legs** on pictures.

XXX.—PLANTS AND MINERALS

Objects and Apparatus.—Natural Objects such as a Bird, a Fish, Insects, Fruits, Leaves; various kinds of Rock, Stone, and Metal (all properly labelled).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Natural Objects.		
(1) The things we see **around us** are either **natural objects** or **made articles** (artificial, or the products of art).	Observation and Experiment.	(1) *Request* children *to point out* first those things which **man has made** (desk, glass, paper). *Request* children *to point out* the things which have **not been made by hands** (the natural objects). *Announce* that this Lesson will be **restricted** to the **natural objects**.
(2) **Natural objects** may be grouped under **three classes**: (*a*) animal; (*b*) vegetable; (*c*) mineral.		(2) *Ask* an intelligent child to sort and **group** all the objects **under three classes**. *Correct* mistakes—*questioning* on them. *Supplement* the objects available by obtaining **names** of others from the children, and writing **grouped lists** on Blackboard. *Arrive at* the fact that **in Nature** there are **three "worlds,"** viz., (*a*) the animal world; (*b*) the vegetable world; (*c*) the mineral world.
(3) Animals and vegetables **have life**, but minerals **have no life.**		(3) *Ask* **which** of the natural objects **possess life**, or did possess life, and have therefore died; and **which never lived**, and therefore cannot die or be killed. *Exhibit* **dead animals** and **dead plants**, and *contrast* with minerals. *Announce* that having had so many Lessons on **animals**, we may begin to **disregard** them in this Lesson after finding to which group they belong.
STAGE II.—Organic and Inorganic Matter.		
(1) Things that possess **life must have working parts** (organs) for maintaining that life.	Observation and Experiment.	(1) *Produce* a box of prepared specimens, consisting of a number of **plants cut up** into roots, stems, leaves, and blossoms; and a number of roughly **broken minerals** of various sizes, such as

Objects and Apparatus.—Natural Objects such as a Bird, a Fish, Insects, Fruits, Leaves ; various kinds of Rock, Stone, and Metal (all properly labelled).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		pieces of limestone, sandstone, flint, coal, chalk, ore, all **mixed up** together. *Empty* the box in front of the class; *bring out* one or two intelligent scholars, and *desire them* to **sort and group** all the same "**parts**" together. *Set an example by commencing* a group of a few **roots** and then a few **flowers**. *Correct mistakes*, and get all the plant "**parts**" properly sorted **into groups**. (A shrewd child may possibly group all the pieces of the same rock, or even try to piece one lump to another at the place of fracture.)
(2) **No working parts** (organs) and no parts dependent upon others can be found **in minerals**.		(2) *Demonstrate* (*a*) that **one piece of a rock** is as much **like another** of the same kind as possible, except so far as accident in breaking up has varied their sizes and shapes; (*b*) that **one part cannot be related to another**, as in plants. *For example*, there is **no mistaking roots** for **flowers**, or **leaves** for **seeds**. *Prove* this over again *by experiment*.
(3) **Plants**, like **animals**, **need nourishment** to keep them alive.	Questioning and Comparison.	*Question* on the **uses of roots** (compare with **mouths** of animals), of **bark** (compare with **skin**), and of **seeds** (compare with **eggs** from which young are hatched). (3) *Ask* what **we take** into our **mouths?** And what **plants take** in at their **roots?**—(Food—nourishment.) *Question* out that **plants**, like animals, **also need air** (tell that they breathe through their leaves), and **water** (as we need drink), and **sunlight** (or they become pale and sickly, like ourselves).

(4) **Minerals** do **not feed,** and therefore they do **not grow.**

(4) *Ask* who ever heard of **feeding a rock** or a stone? or what **kind of food** such things needed? or even if they **required air** or **light?**—(No answer.)

When we **cease to eat** what will happen to us?—(**We die.**)

Then **why** do we **take food?**—(To make us **grow,** or to **maintain the strength** of life.)

Exhibit a **seedling,** or young plant, and *inquire* **how it will alter** if carefully planted.—(It will **grow larger** and stronger.)

Inquire **whence** the additional **size and strength** are derived?—(From the **nourishment.**)

Now suppose we **plant a bit of slate,** or a bit of coal, why will there be **no growth?**—(**No taking in** of nourishment.)

Challenge the class to point out in a mineral **any part corresponding to a mouth** or a root, or any feeding organ whatever.

Discover that by **no possibility** can a **mineral** be **made to grow**; whereas a **plant can,** if its organs or **working parts are set properly to work**—thus it would be **useless** to plant it with the **flowers set in the ground,** and the **root left up in the air.**

Ask why?—(Because the **feeding organs** or roots could **do no feeding,** and the **breathing organs** or leaves, **no breathing.**)

Repeat and emphasise the **conclusions** arrived at—

(i.) A mineral is of the **same substance throughout.**
(ii.) ,, has **no working parts** or organs.
(iii.) ,, **cannot eat, drink, breathe,** or **grow.**
(iv.) ,, has **no life,** and therefore cannot die.

Offer food for reflection in the statement that the **animal world** depends on the **vegetable world,** and the **vegetable world** on the **mineral world**—the **grass grows** out of the earth, and **animals feed upon it**—everything comes out of mother earth, and in the end everything returns to the earth. Thus are the **natural worlds related** to each other.

STAGE III.—Exercises.

(1) **Everything** in the world **belongs to** one of the **three kingdoms of**

Tests.

(1) *Set class* to make three **lists of objects** under the **headings** of their **respective natural kingdoms.**

Objects and Apparatus.—Natural Objects such as a Bird, a Fish, Fruits, Leaves; various kinds of Rock, Stone, and Metal (all properly labelled).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
nature—the animal kingdom, the vegetable kingdom, the mineral kingdom,* and can be classified under these three heads.		*Accept* in this exercise the **simple names** of animals, plants, and minerals. For a second exercise *set a more difficult test* by writing on B.B. a **list of manufactured substances** (paper, pencil, rubber, beer, milk, leather, bricks, salt, pepper, &c., &c.), and *requiring* the **head, or heads**, under which **each** may be **classed**. For example :— *Substance or Article.* — *Natural Kingdom.* Knife, — Mineral (blade) and animal (handle). Paper, — Vegetable. Lead pencil, — Mineral (plumbago), vegetable (wood). A great *help will have been given* to this exercise, if all the objects used in the school have invariably been properly labelled. *Supplement by brief explanations* as to the **raw material** from which certain of the lesser known substances have been manufactured.

* For simplicity, and with a view to avoiding the terms "organic" and "inorganic," a mineral may be defined to include, not only matter obtained from "mines," but other matter existing above the earth's surface, and having no working parts (no organs). Thus air and water are brought within the mineral kingdom.

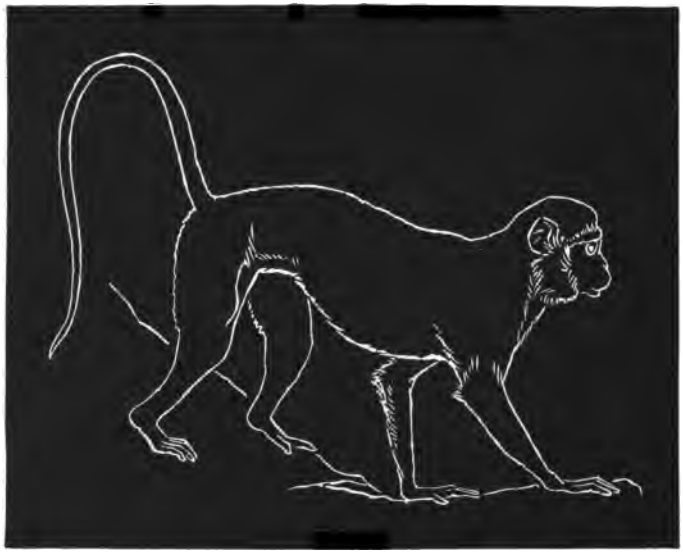
PART III

I.—MONKEY

Objects and Apparatus.—Pictures of Monkeys, Baboons, and Apes (various, but to same scale).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictures of Monkeys.		
(1) Monkeys are the **most man-like** of all animals.	Observation.	(1) *Note* that monkeys have a **covering of hair.**
(2) A great point in the resemblance is the **mouth,** which **projects** but **little.**	,,	(2) *Contrast* with **projecting mouth of dog** or other animal. *Show* **resemblance** between human and monkey **features.**
(3) The **body** is slender and slight, yet **lithe and muscular.**	,,	(3) *Compare* with the **human figure.**
(4) The **limbs** are **long** and flexible, and are terminated by **hands** fit for **grasping.**	,,	(4) *Mark* this as the great feature—monkeys have **no feet**—they are **four-handed.** *Mark* the **length** of the **fore limbs,** and *contrast* with length of a man's **arms.**
(5) There are many **sorts** of monkeys; yet they may all be classed in three divisions, namely—	,,	(5) *Point out* **diversity** of size, shape, and feature. *Group* the monkeys depicted under their three heads. *Note* **gradation** from man to animal.
(*a*) Those with no tails and no cheek pouches (**apes**).		(*a*) *Note* these as **most man-like** of all. *Call* them **apes.**
(*b*) Those with short tails and with cheek pouches in their dog-like heads (**baboons**).		(*b*) *Tell* that these are called **baboons,** and have **cheeks** the inside of which they can **use as pockets** for food.
(*c*) Those with long tails and cheek pouches (**monkeys**).		(*c*) *Name* these as **true monkeys**; in the **Old World** using their **tails** as **balancers,** after the manner of a rope-walker; and in the **New World** using their (**prehensile**) **tails to hold.**

STAGE II.—Questioning on Foregoing Examination.		
(1) Monkeys often affect the **erect position** like man.	Questioning.	(1) *Ask* which is the **direction** of a **man's backbone?**—(Vertical.) And which of an animal's?—(Horizontal.) What animals **sit up** very much?—(Kangaroo, squirrel, monkey.) Which of all these have **hind limbs most like man's?**—(Monkey.) *Contrast* **bodies and limbs** of man and monkey with those of **quadrupeds.**



A Monkey.

MONKEY—*Continued*

Objects and Apparatus.—Pictures of Monkeys, Baboons, and Apes (various, but to same scale).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) Monkeys **mostly** walk **on all fours**; even when they **walk** on their hind legs they can **only hobble.**	Questioning.	(2) When is a monkey's **body erect,** when he is **walking,** or sitting?—(Sitting, generally.) When a monkey holds himself **upright** to walk, are his **movements gainly or awkward?**—(Awkward.)
(3) Monkeys have **four hands** for grasping, because their **lives** are **spent in trees** instead of on the ground.	,,	(3) *Question out* the **difference** in the respective **ways of walking**—the **sole** of the monkey's "foot" does **not come to the ground**—a **dog can walk** on its hind legs **quite as well** as a monkey. *Contrast* the **quadrumana** with the **quadrupeds.** *Ask* which **limbs** we should bring into **use climbing.**—(Arms and hands.) Which are **better** for **grasping,** hands or feet?—(Hands.) Which for **reaching** and **springing,** short limbs or long flexible arms?—(Long arms that reach and bend.) Which is **safer in a tree,** man or monkey?—(Monkey.) And which **most gainly on the ground?**—(Man.) Why do monkeys **need a body** so **lithe and muscular?**—(To spring about from branch to branch so easily.)
(4) **Apes** are monkeys **without tails,** and the most man-like of all the monkey tribe.	,,	(4) Which **kind of** monkey is **most erect** and most man-like?—(Apes.) What is **absent from the ape** which brings him **nearer** to the likeness of **man?**—(The tail.)
(5) **Baboons** have **short tails,** and **pouches** in their cheeks; they live on rocks and mountains.	,,	(5) What **sort of tails** have **baboons?**—(Short.) What have they **inside their cheeks?**—(Pouches.) **For what** are these pouches **used?**—(To store food.) When do **we carry food** in our **pockets?**—(When needed for future use.) **If** the baboon **stores up food** in this way, does he have to **travel far** from his native rocks **for a meal,** or find it close at hand?—(Far.)

(6) **Monkeys** have both **long tails, and pouches** in their cheeks.	,,	(6) Which **kind** live mostly **in trees?**—(Monkeys.) Which are **less man-like,** and **more** of the **animal?**—(Monkeys.) Of what **use** are their **tails** to monkeys?—(To **grasp** or to **balance.**)
(7) **All monkeys** have but a **low,** slanting **forehead,** while their **jawbones** are thick and **strong.**	,,	(7) **With what** do we do our **thinking?**—(Brain.) **Which** looks the **more intelligent,** a low or a **high forehead?**—(High.) If the **monkey** has a low forehead and **small brain space,** will he be more **intelligent** than man, or **less?**—(Less.) Do his **great jaws** and **teeth** bring him **nearer** to man or **to the beasts?**—(Beasts.)
STAGE III.—Structure and Habits.		
(1) **Apes approach man** nearest because they can maintain an **erect position.**	Comparison.	(1) *Point out* (i.) that the **form and attitude** may be similar, but the **hinder limbs** are better **suited** for **holding** (prehension) **than** for **support;** (ii.) that the **fore limbs** have **great length** while the **hind limbs** are **short.**
(2) The **features** present a striking **contrast** to those of even the **most degraded human being.**	,,	(2) *Point out* (i.) the receding **forehead;** (ii.) the flat **nose;** (iii.) the muzzle-like **jaws;** (iv.) the enormous canine **teeth.**
(3) **Baboons** are often called the **dog-headed monkeys.**	,,	(3) *Note* that **head and muzzle** of a baboon **resemble** the head of a dog.
	Telling.	*Give* the **sign** for recognising **all baboons** as the position of the **nostrils,** which are placed at the **end of the muzzle,** instead of lying upon the face just beneath the eyes, as **in all other monkeys.**
(4) The **true monkeys** are more slender and **better proportioned;** those of the New World have no cheek **pouches,** but are furnished with prehensile **tails.**	,,	(4) *Point out* the slender and **more gainly forms** of the true monkeys. *Describe* them as **living entirely in the trees,** and **swinging** from branch to branch **as they feed.** *Describe* the **tail** as having **no hair** at the **tip,** being **sensitive** as a **finger** for feeling and grasping.

MONKEY—*Continued*

Objects and Apparatus.—Pictures of Monkeys, Baboons, and Apes (various, but to same scale).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(5) Monkeys **feed** on nuts, soft fruits, roots, birds' eggs. They live only in **hot countries.**	Telling.	(5) *Connect* their **food** with their **habits**—tree livers feed on **what trees provide.**
(6) In **character** the apes and baboons are **fierce or sullen**; true monkeys are **playful and imitative.**	,,	(6) *Relate* any **anecdote** illustrative of the sportfulness or imitative powers of the monkey.
STAGE IV.—Recapitulation and Additional Information.		
Monkeys and apes differ from man in—		By recapitulation *review main points* of Lesson, *dwelling on* **comparison with man.**
(*a*) Their coarser features, ill-shaped and ungainly bodies. (*b*) Small brain space and lower intelligence. (*c*) Inability to stand perfectly upright. (*d*) Hands instead of feet, which cannot be placed flat on ground, but only sideways. (*e*) A leg having no calf and a knee that cannot be straightened.		*Contrast* to be taken between the **ape and man.**
The **gorilla** of Western Africa is the **largest** of the monkey tribe.		*Tell* that **gorilla** is the **height** of a man (5 ft. 6 in.), **fierce and savage**, dwelling in the **deepest forests.**
When the arms of **apes** are so long that they reach the ground when the creature is erect, the **knuckles** must be **held downwards for walking upon.**		*Point out* these features of the **knuckle-walkers,** as in the **chimpanzee.**

A Baboon.

II.—ELEPHANT

Objects and Apparatus.—Picture of Elephants, African and Asiatic; Ivory.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture of Elephant.		
(1) The elephant is a **very large four-footed** animal.	Observation.	(1) *Note* that it is **several times the size of a horse**; *name* it to be the **largest of land animals.**
(2) It has a **body of great bulk**, supported by **thick, short legs.**	,,	(2) *Note* the apparent **heaviness of the body,** and the **pillar-like legs supporting** such weight.
(3) The **legs** are **unshapely but strong.**	,,	(3) *Note* that the legs are **not shapely like those of a horse**—the **hinder ones** being apparently **without the hock joint,** which in the horse corresponds to our heel—the elephant's heel is concealed within the foot.
(4) The **foot** is large; there are five **nails** on each fore foot, and four on each hind foot.	,,	(4) *Compare* with **solid hoof of horse.**
(5) The **head** is massive, **to match** the bulkiness of the immense body.	,,	(5) *Draw attention* to the **fitness** of a **massive head** to a **massive body.**
(6) There is little or **no neck** to connect the head to the body.	,,	(6) *Discover* the **source of weakness** a "narrowing" neck would be to carry so weighty a head. *Contrast* with **handsome head,** carried on a **shapely neck,** in the **horse.**
(7) There is a **trunk,** which can grasp and hold, and which **supplies the place of a long neck** in reaching for food.	,,	(7) *Compare* with a **horse grazing** from turf at his feet, or **reaching hay from a rack** above its head.
(8) The elephant has **two long teeth** in the upper jaw, **called tusks.**	,,	(8) *Exhibit* the specimen of **ivory**; *tell* that in the **Indian elephants** tusks are possessed **only by the male.**
(9) The elephant is covered by a **thick skin** with a **scanty covering of bristles**; and the **long tail** ends in a **tuft of bristles.**	,,	(9) *Name* the elephant among the **thick-skinned** animals (*pachyderms*).

(10) The Asiatic or **Indian elephant** has **small ears,** while the **African elephant** has **very large flapping ears.** (11) The **African elephant** has a round and **bulging head,** while that of the **other is flat,** or indeed hollow.		(10) *Distinguish* on the pictures. *Tell* that the **African elephant never** makes a **willing worker,** while the Indian elephant is captured and readily tamed. (11) *Point out* these **distinguishing features.** *Tell* that in the African elephants, **both male and female possess tusks,** for which they are **systematically hunted.**
STAGE II.—Questioning on the Foregoing Examination.		
(1) The elephant is the **largest land animal.**	Questioning.	(1) What is the **largest animal?**—(Whale.) The largest **land animal?**—(Elephant.)
(2) Its body is a great **mass of muscle, protected** by a **thick skin,** and **supported** on **strong legs.**		(2) *Lead questioning to show* that (i.) elephant's bulkiness is **not fat but muscle;** (ii.) that muscle **wields strength;** (iii.) that **strength** is also **needed in legs** to support weight of body; (iv.) and that all strong **working parts need a strong covering.**
(3) The **legs** are constructed **for strength rather than speed.**		(3) *Question to recall* that the elephant moves with a **stiffer, graver progression** than the free elastic pace of a horse.
(4) The **trunk** is the **most convenient feature** for a great animal with **no neck to reach food,** and often with **tusks** that **stick out** so far.		(4) What is the **use of a long neck** to animal or bird?—(**To reach food.**) **How** does the **elephant reach** grass on the ground, or leaves on a tree?—(**By using his trunk.**) **How** does the elephant **drink?**—(**Sucks** water into trunk and **pours it into mouth.**) So **what** replaces the elephant's **neck?**—(His trunk.) **If** the elephant had **no trunk, what** would **prevent** him **feeding** from a manger?—(**Projecting tusks.**)
(5) The **trunk** is used both as **a hand and a nose.**		(5) *Show* that the **trunk** is a development of the **nose,** with two **nostril openings;** and that it **serves as a hand.**
STAGE III.—Structure.		
(1) The elephant generally stands eight to ten feet **high,** and **weighs** many tons.	Telling and Comparison.	(1) *Compare* with height of a **man, or a horse** (to withers); the weight of a horse may be one ton, and an **elephant fifty tons.**
(2) The stumpy **hind legs bend backwards,** as a man's legs bend when he kneels.		(2) *Contrast* with the shapely **hind legs of a horse,** which are **brought forward** under the body **when bending.**

ELEPHANT—*Continued*

Objects and Apparatus.—Pictures of Elephants, African and Asiatic; Ivory.

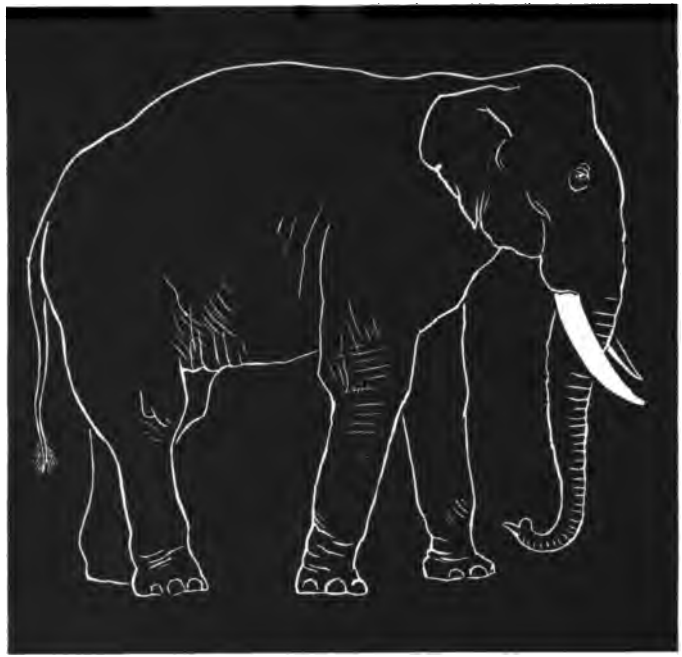
MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) The outer and inner surfaces of the **skull** are separated by **a number of cells** somewhat like those of a honeycomb.	Telling and Comparison.	(3) *Demonstrate* (i.) the enormous **weight of the head**, with its trunk, tusks, and great grinding teeth; (ii.) **shortness of neck** being **an advantage** in carrying such weight.—*Experiment* weight-carrying with a **long lath**; (iii.) the **combined lightness and strength** in these **bony cells** of the forehead. *Mention* (i.) the use of the head as a **battering ram** when **wild**, and as a **pushing ram** when **tamed** for work; (ii.) the fact of **bullets** lodging **in these bony cells without harming** the
(4) The trunk (*a*) is a tube, pierced by **two canals**, which are prolongations of the nostrils.		(4) (*a*) *Compare* with **our nostrils** or nose-holes. [beast.
,, (*b*) has the **canals compressed** where they meet the **bone of the head.**		(*b*) *Compare* with the compression of the sides of a **rubber pipe**, squeezed together at the end.
,, (*c*) can be kept **closed at the top by valves** at the will of the beast.		(*c*) *Instance* **necessity of closing** to prevent ascent of **water** which is **taken in** when creature needs **drink.**
,, (*d*) can be coiled, elongated, contracted, and **moved in all directions.**		(*d*) *Attribute* this great **flexibility** to the **50,000 muscles** which cross and recross in every direction.
,, (*e*) has a **tip** at the end **like a finger.**		(*e*) *Compare* with our **first finger**, opposed to the thumb, and **capable of picking up very small objects.**
,, (*f*) has **four uses**, viz.:— (i.) To **gather food.** (ii.) To take up **water.** (iii.) A **puff** instrument. (iv.) An organ of **touch.**		(*f*) (i.) *Instance* it as both a **hand and a nose in selection of food.** (ii.) ,, the taking both for **drinking or squirting** over the body. (iii.) ,, **puffing of dust** over its wet body to form a crust of mud as protection against flies. [path. (iv.) ,, the **feeling of the way**, to discover dangers in the

STAGE IV.—Habits.

(1) The **food consists entirely of vegetable substances**; as grass, leaves, fruits, and pith of palm trees, sugar cane.

Telling.

(1) *Tell* the **vast amount of food** eaten—how the head **pushes down trees** to get at its leaves—how the tusk **splits open palms** to reach the pith—of its **molar teeth** a foot long.



An Elephant.

ELEPHANT—*Continued*

Objects and Apparatus.—Picture of Elephants, African and Asiatic; Ivory.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) Elephants **live in herds** of ten to thirty, always near to **water, in which they delight.** Elephants are fond of submerging their whole bodies, leaving only the trunk tip above water. (3) The elephant roars and **trumpets.**	Telling.	(2) *Surmise* a **herd** to be all **one family.** *Mention* the "**rogue**" elephant living a solitary life, and always **very savage.** *Tell* how they like also to **wallow in mud,** which they allow to harden upon their skins beneath the hot sun, and so encase them in armour against fly stings. (3) *Distinguish* the first sound as proceeding **from the mouth,** and the latter **from the trunk.**
STAGE V.—Character and Uses. (1) The elephant has **immense strength, combined with singular intelligence.** (2) The **Indian elephant** is captured, easily tamed, and **employed in all kinds of work.** (3) **African elephants** are **hunted** for the **ivory** they yield.	Telling.	(1) *Call forth* **admiration** for the **usefulness of a creature** in which these two qualities go hand in hand. (2) *Relate* **anecdote** of capturing by **decoy elephants** luring a wild herd into **strong enclosures.** *Specify* work, as: road-making, wall-building, timber-carrying, and as a **beast of burden generally.** *Note* its employment in **hunting** and in **warfare**—its **preference to pushing loads** with its head, to being harnessed with chains and other trappings. *Note* that the driver or **mahout** sits on the head, and the passengers ride in a **howdah.** (3) *Differentiate* the **two kinds** by *reviewing Lessons.* *State* that some **tusks** weigh 150 lbs.—**the weight of a man.** *Elicit* the **uses of ivory**—handles, piano-keys, ornaments and trinkets, bagatelle balls.

III.—BEAR

Objects and Apparatus.—Pictures of Bears (various, and to same scale); Specimen of Bear Fur.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictures of Bears (Common Features). (1) The bear is a **large, clumsy-looking** animal. (2) The **soles** of their feet are placed **on the ground.** (3) The feet are armed with long, **curved, sharp claws.** (4) Bears are covered with **long shaggy hair.** (5) Their **ears** are small, their **noses** are pointed, and their **tails** short.	Observation.	(1) *Compare all* the bears represented, *to discover* their **resemblances** in these **common features.** (2) *Contrast* with dog, or cat, or any **toe-walker,** whose heel is lifted well away from the ground. (3) *Point out* these formidable **talons.** (4) *If possible exhibit* some **bear fur**—*bury* the hands right in it. (5) *Point out* these **features severally.**
STAGE II.—Examination of Several Varieties. (1) There are several little **groups of bears,** each differing from the others. (2) **Brown bear**:— (*a*) Is one of the **smallest** kinds. (*b*) Has soft fur of **brown** varying in **shade,** dark to pale. (3) **Grizzly bear**:— (*a*) Is **larger** and **fiercer** looking. (*b*) It is **grey** to blackish **brown** in colour. (*c*) The **claws** of fore feet are **longer and less curved** than the others.	Observation.	(1) *Point out* the several **varieties** depicted. (2) (*a*) *Estimate* 2½ feet, or the **height** of the table. *Mention* that **black bear** of North America is less. (*b*) *Point out* **colourings.** (3) (*a*) *Estimate* it at **twice the size** of the brown bear—it **sits up nine feet** high. (*b*) *Note* that fur is **paler** on the **muzzle**—and short round the small sunken **eyes.** (*c*) *Point out* that they are **formidable** weapons, about six inches long, better **suited to digging** than climbing.

BEAR—*Continued*

Objects and Apparatus.—Pictures of Bears (various, and to same scale); Specimen of Bear Fur.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(4) **Polar** or **white bear**:— (*a*) Is the **largest** of the bears. (*b*) The **head** is **smaller** and set on a **longish neck**. (*c*) Its fur is of a **creamy white**.	Observation.	(4) (*a*) *Note* that **not only** is it **heavier**, but its **fur** is even **thicker**. (*b*) *Point out* the **snake-like** form of head and neck. (*c*) *Mark* the great **contrast** with the colouring of the **other bears**.
STAGE III.—Questioning on Foregoing Examination.		
(1) Bears have a clumsy **shuffling gait** because they are **sole-walkers**.	Questioning.	(1) **What biped walks** up his entire sole from heel to toe?—(**Man.**) And **what quadruped?**—(Bear.) **Which** of these **requires** to do so to give him a **firm base** to stand upon?—(Man.) But **when a four-footed** animal walks upon the whole foot **does it give him** an easy or a **shuffling walk?**—(Shuffling.)
(2) Bears **sit up** easily and **walk on their hind legs** easily.		(2) *Educe* the **ease** with which bears **assume the erect position**—*contrasting* with dogs and other **toe-walkers**.
(3) Bears are classed at the **end of the flesh-eaters**, because they eat a **mixed diet** of flesh and vegetables.		(3) **How** do wolves and others of the **dog tribe** get their **prey?**—(**By speed.**) **How** do lions and others of the **cat tribe** get their **prey?**—(By **stealthy activity.**) **If bears have neither** stealthy activity to approach, or speed to overtake their prey, **will they be eaters** of much or **of little flesh?**—(Little flesh.)
(4) Bears are **good climbers**, and seek food in trees. They live in **caverns**, **hollow trees**, and holes in the earth.		(4) What is the **use of strong claws?**—(Digging.) Of **curved claws?**—(Climbing.) **What food** may be found **by climbing** and scratching?—(Fruits, roots, honey.) For **what purposes** are **holes dug out** by animals?—(Dens, and hiding-places for food.)

(5) The **polar bear** is a powerful **swimmer**, and lives entirely upon **flesh of fish and sea animals.**

(6) **Thick fur** is useful for **cold regions**, or for long **winter sleeps.**

(5) **If** the polar bear lives in the ice-bound north where there is nothing growing, and **no animals** on the land which can be caught for prey, **where else** may he **hunt?**—(Sea.) **What** are to be caught in the **sea?**—(Fish, seal, walrus.) **So what must** the polar **bear** be **able to do** to hunt for fish and sea animals?—**(Swim.)**

Compare **broad hairy paws** with those of spaniels and other **water dogs.**

(6) **When** do we **need warmer clothing**, in the cold or the warm **season?**—**(Cold.)** **When** we are at work or **asleep?**—(Asleep.) **Which** bear **needs** his **thick coat** all the **year round?**—(Polar.) **How** do **some animals** pass the **winter** when **food** is **scarce?**—(In a long sleep.) **If bears** are **not good hunters**, and **live** largely **on vegetables**, when will they find their **warm fur serviceable?**—**(Sleeping** away the **winter.)**

STAGE IV.—Structure and Habits.

Telling.

(1) (*a*) The **brown bear** inhabits the **forests of Europe**, from Norway to the Alps. It was **formerly** found in **England.**

(*b*) The **grizzly bear** lives in **America.**

(*c*) The **polar bear** lives in the **polar regions**—the **largest**, and almost the only **animal** found **there.**

(1) (*a*) *Point out* on **map.** *State* that the bear has been **extinct in** this country for a **thousand years**, but the name **Bardon Hill** in Leicestershire is said to mean "bear den" hill.

(*b*) *Locate* in **California** and the **Rocky Mountains**, if knowledge of geography warrants the detail.

(*c*) *Connect* **name** with **habitat**—*briefly describe* desolate and **inhospitable regions**—*question out* how the great **polar bear manages to sustain life** there.

(2) The **brown bear**—

(*a*) Eats corn and **fruits**, scents **honey**, and **preys on small animals** when pressed by hunger.

(2) *Offer the memory* the fanciful name "**bruin**" or "brown coat," often familiarly applied.

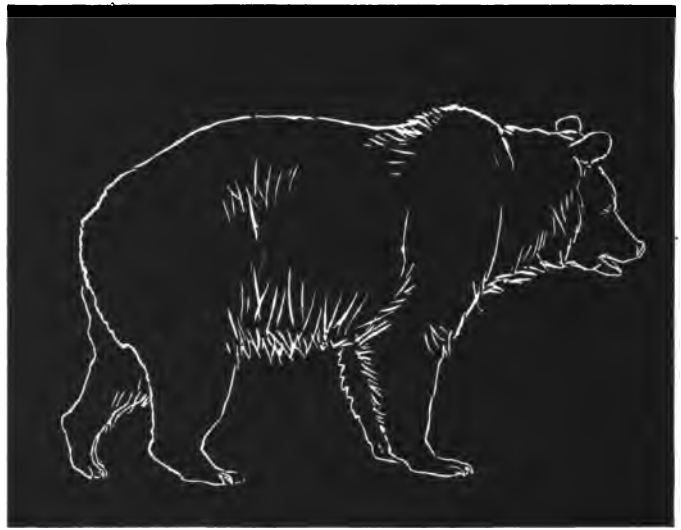
(*a*) *Describe* the **scenting out** of wild bees' store of **honey**—Bruin's **raids** upon it—his **thick fur** proving a complete **defence against the stings** of the enraged bees.

BEAR—*Continued*

Objects and Apparatus.—Pictures of Bears (various, and to same scale); Specimen of Bear Fur.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*b*) **Gets very fat** in summer, and **sleeps through the winter** nourished by this fat.	Telling.	(*b*) *Describe* how **quickly** this layer of **fat forms** under the skin—and how, **in spring**, the bear **rouses up** and issues from his den or tree, thin and ravenously "**hungry as a bear.**"
(*c*) **Flies** rather than faces **man**; when **attacked** all **bears sit up**, and **strike** tremendous blows **with the fore-paws.**		(*c*) *Describe* the **rearing up**—the pause—the sudden **rush** and delivery of fearful **blows**—the **laceration** made by the claws—the **embrace**, and the hug which **crushes the life out** of victims.
(3) The **grizzly bear**—		(3) *Explain* **grizzly** to mean "horrible" or "**frightful.**"
(*a*) Is the most **ferocious**, and the only bear which will **attack man unprovoked.**		(*a*) Hence *derive* name.
(*b*) Is **not** a good **climber.**		(*b*) *Explain* that **none** have **retractile claws**—the claws are **only blunted** by the wear—yet they grow **very long**, and as they are **straighter in this bear**, he climbs with difficulty.
(4) The **polar bear**—		(4) (*a*) *Liken* to **woollen list**, sometimes wrapped round the **outside of our shoes** in slippery weather.
(*a*) Has long **hairs** on the **soles** of his feet, which **give security** in walking over **slippery ice.**		(*b*) *Claim* it as **protective also**—white fur cannot be seen against snow background, or on ice-fields—the Arctic summer lasts but a few weeks.
(*b*) Has **white fur**, because this colour radiates or **throws off heat less readily** than darker hues.		(*c*) *Elicit* **digging powers**; *state* that the **two cubs are born** here.
(*c*) Makes a **hole in the snow** in which to pass the **winter** in a state of **torpor.**		*Mention* that the **male** does **not hibernate**, but roams in search of prey.

STAGE V.—Recapitulation and Additional Information. Bears are **hunted** for— (*a*) Their **skins.** (*b*) Their fat and their flesh.	Telling.	After recapitulation for review of main points— (*a*) *Name* uses, as **rugs** and soldiers' busbies. (*b*) *Mention* "**bear's grease**," which is applied to human hair to preserve the scalp; **bear's-meat** is sometimes eaten, fresh or **cured.**



A Brown Bear.

IV.—DUCKBILL

Objects and Apparatus.—Picture of Duckbill (*Ornithorhynchus*); Picture of Duck; Picture of Mole; Picture of Otter.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture of Duckbill.		
(1) The duckbill (or water-mole as it is called in New South Wales) is **a strange-looking quadruped.**	Observation.	(1) *Refer* to the **peculiar forms of life** found in Australia, and present this as one of **the strangest.** *Name* it the duckbill, or the water-mole.
(2) (*a*) **Instead of a muzzle** it has a broad flat **duck's bill.**		(2) (*a*) *Cover* the bill *with the hand*, and *ask the class* **what one would expect to terminate such a head**—a hairy muzzle, not a horny bill, or leathery membrane.
(*b*) This bill has **a leathery flap** or flange where it joins on to the head.		(*b*) *Liken* this to a **guard between the blade and handle** of a steel or a dagger.
(3) The **eyes** are small but very bright; the **ears** cannot be seen.		(3) *Tell* that the ears are **simple holes**—closed or opened **at will.**
(4) (*a*) The **fore feet are webbed,** between the five blunt claws.		(4) (*a*) *Note* that the leathery **web is very large,** extending **beyond the tips** of the claws.
(*b*) The **hind feet** are smaller; and though webbed, leave the five **claws** strong and projecting.		(*b*) *Note* these **great differences.**
(5) (*a*) The **body** is elongated, low, and depressed.		(5) (*a*) *Note* relative **length** of body—and **how little it is lifted** from the ground by the limbs.
(*b*) It is covered with fine close **fur.**	Telling.	(*b*) *Describe* the longer hairs as **glossy**—there is an **under layer** of short **waterproof wadding.**
(*c*) The **tail,** which is broad and moderately long, has longer and coarser hairs.		(*c*) *Measure off* on blackboard four or five inches as **length of the tail**—a **beak half that length**—total length of animal being twenty to twenty-three inches—*convey ideas* of all these measurements—*compare* with size of a **cat.**

STAGE II.—Questioning on Foregoing Examination.

(1) The duckbill has **a bill and web feet,** as a duck has.

(2) The leathery **flap** on the bill **protects the eyes and fur** from mud.

(3) Because it can **burrow as well as swim,** it has also been named the water-mole.

(4) Because it burrows, its **limbs are short,** its **eyes small,** and its **ears** can be **closed** at will.

(5) The duckbill produces its **young from eggs,** like a bird, and **then suckles the young** as a mammal.

Questioning.

(1) **Why** is this creature **called** a duckbill?—(Because it has a bill like a duck.) What **else has it like a duck?**—(Webbed feet.) What are **webbed feet for?**—(Swimming.)

(2) **For what** does a duck use **its flat bill?**—(Grubbing in soft mud.) Suppose the duckbill also feeds in mud, **what has it** at the root of its broad bill **to defend the eyes and the fur** from the mud?—(A horny flange or stop-flap.)

(3) For what purpose has a mole strong claws?—(Digging and burrowing.) Because the duckbill can swim in water, and has also claws for burrowing, what other name has it received?—(Water-mole.)

(4) If an animal burrows, why should its **legs be short?**—(For creeping through **tunnels.**) **How and why** are its eyes and ears **like** those of a **mole?**—(Eyes are small, ears are only orifices which can be opened and closed at will.)

(5) **Which** is the duckbill **more like,** the duck or the mole?—(**Mole.**) In **what respects?**—(It is a **quadruped,** and is covered with **fur.**) What is the **great difference** between the **young of a bird,** and the **young of a fur-covered mammal?**—(The young of a bird are produced from **eggs,** the young of a mammal are born alive and are **suckled.**)

Telling.

Tell that this strange creature **does both**—lays eggs and suckles its young.

Tell that the **beak of the young is very short,** to allow of sucking.

STAGE III.—Structure and Habits.

(1) The duckbill or water-mole is a **striking** animal found in Australia; it is **a mammal,** with some of the **features of a bird.**

(2) (*a*) The **beak** is hard for **cracking shells;** it has **no teeth,** and **no ridges** for straining water.

Questioning.

(1) *Question out* these peculiar **features which strike** the observer—

(*a*) Like a **mammal** in having **four legs,** being **fur-covered,** and **suckling** its young.

(*b*) Like a **bird** in having a **beak, web-feet,** and **laying eggs.**

Telling.

(2) (*a*) *Tell* that it feeds on small **shell-fish,** which it **grubs up** from the mud, and **cracks** with its strong toothless jaws.

Contrast with the **soft food** of the **duck,** which has ridges along the edges of its bill to act as a **strainer.**

DUCKBILL—*Continued*

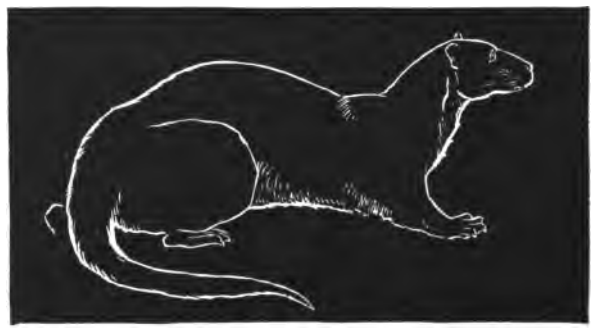
Objects and Apparatus.—Picture of Duckbill (*Ornithorhynchus*); Picture of Duck; Picture of Mole; Picture of Otter.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*b*) The **tongue** is short and thick, and covered with sensitive ridges (papillæ); and there are **cheek pouches** for storing food.	Telling.	(*b*) *Compare* with **sensitive tongue** of the duck, which feels for and **selects food from a mouthful** of mud. *Tell* that the duckbill hunts for food, **stores up** all it catches in **cheek pouches** like a monkey, and **eats afterwards** at leisure.
(3) (*a*) The duckbill **swims** and dives with ease, and **burrows** like a water-rat.		(3) (*a*) *Question* on **structure**, to lead up to these **several habits.**
(*b*) It makes its burrow on the steep **banks of the streams** and tranquil waters in which it seeks its food.		(*b*) *Lead on* to this from previous step.
(*c*) Here it **sleeps all day**, curled up, with its tail shut over its head for protection.		(*c*) *Describe* the **burrow** as having a **large opening**, then a **narrow passage**, and then **another enlargement** at the end for the comfort of the parents and their offspring.
STAGE IV.—Recapitulation and Additional Information.		By a recapitulatory review *bring out the main points* of the Lesson. Then *may be added*—
(1) **Australia** is a land altogether **strange** in its animal and vegetable **life.**	Telling.	(1) *Instance* the facts that in a general way its **antipodean character** is strange to European ideas; and among its oddities may be noted that **cherries** have their stones outside, the **trees** shed their bark, not their leaves, and **flowers** have no scent; that **bees** have no sting, many **birds** no song; and strangest of all there is a **mammal that lays eggs**, to say nothing of a **quadruped which runs on two legs** (kangaroo).

(2) Among all its **oddities, nothing is stranger** to our ordinary conceptions than the platypus or duckbill.

(2) *Wind up by saying* that while this "smallest of continents in the largest of oceans" is rich in **insect life**, and has many **poisonous snakes**; while it possesses **large birds** of the ostrich type (the emu and the cassowary), and very **many** of graceful **form** and beautiful **plumage**, and yet most of them **without song**; while the **large animals**, such as the tiger and the elephant, **are wanting**, its largest flesh-eater being a native dog or **dingo**, and all the **useful animals**, such as the horse, sheep, and ox, had to be **introduced**; and while all its **characteristic** animals are **pouch-bearing mammals**, yet, after all, there can nothing be stranger than the duckbill, **which seems** to be **a beast, a bird, and a fish**, all rolled into one!

A Duckbill.



An Otter.

V.—KANGAROO

Objects and Apparatus.—Picture of Kangaroos; Pictures of other Marsupials.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Picture of Kangaroo. (1) The kangaroo is a **four-legged** animal which **sits up** almost constantly **upon its hind legs.** (2) The **hind legs** are large and powerful, whereas the **fore limbs** are small. (3) The **tail** is also large, like the hind-quarters, and is used for resting upon. (4) The kangaroo has **a pouch** in front in which **to nurse its young.** (5) On each fore foot are five **toes**, and on each hind foot, four; the **nails** are quite hoof-like, particularly one on each hind foot. (6) The kangaroo is a **large animal**, with a gentle, **deer-like head**, and is covered with tawny, **yellow hair.**	Observation.	(1) *Count* the **four legs**, then the **two** which seem to be the **only** ones **used**, and *remark* on this **strange** use of legs by a **quadruped.** (2) *Note* the wonderful **length of hind legs** and feet, **many times** longer than **fore paws.** (3) *Note* this curious **attitude** when **resting or feeding.** *Liken* to a tripod or a **three-legged stool.** (4) *Reckon* this strange **feature** in its structure **as striking as** was the animal's **attitude**, which was noticed at the first glance. (5) *Count* the **toes.** *Draw attention* to the **formidable weapon** which the longest nail supplies. (6) *Estimate* that the common kangaroo, when full-grown, sits up **taller than a man** stands—six or seven feet. *Note* **dark markings** down the back, on the hands, feet, and tail.
STAGE II.—Questioning on the Foregoing Examination. (1) The kangaroo **sits up** constantly **to feed** on tall, luxuriant grass, or the tender tops of plants. (2) The **chief power** of the kangaroo's body is **placed in its hind-**	Questioning.	(1) With its **deer-like head**, may we expect the kangaroo to be a flesh-eater, or **a vegetable feeder?**—(Herbivorous.) **If it grazed**, where should we expect to find its **head carried**, low down towards the grass, or high up?—(**Low down.**) But as it is **a vegetable feeder**, always carrying its **head high**, where is it likely to **find its food?**—(**Tender shoots of trees.**) (2) In **which part**, the fore-quarters or the hind-quarters, does all the **strength** of the animal **seem to be placed?**—(Hind-quarters.)

quarters; when alarmed it moves at **great speed** by rapid and powerful **leaps.**

(3) The **tail** is thick and strong, **assisting** the animal not merely to sit up, but **to take its tremendous leaps.**

(4) The sharp and powerful **claw** on the hind foot **delivers** a tremendous and **dangerous blow** at any foe which turns the kangaroo to bay.

(5) The **young are born weak** and defenceless, and so the parent is provided with **a pouch to carry them in.**

When it **flies** from danger **which legs** will it use most?—(Hind legs.) What would **such movements** be like?—(**Leaps** or bounds.) Why do these **timid grass-eaters** need to **fly** fast?—(**To escape enemies.**) Why **could not** the kangaroo **run gainly** on all fours?—(**Different length of legs.**)

(3) What do we **call** those **elastic threads** in our bodies which enable us to **effect all movements?**—(**Muscles.**) **Does** the kangaroo's **great tail hang down limp** and useless, or appear to be full of strength?—(**Full of strength.**) **What** are inside this great tail to **give it this strength** of movement?—(**Muscles.**) Then not only when resting, but at **what other times does this muscular tail prove useful?**—(When leaping.)

(4) What will these timid grass-eating kangaroos **do when hunted** by an enemy?—(**Fly.**) Supposing their great **speed fails** to carry them out of danger, with **what weapon** can they fight?—(**Nail** of hind foot.) **Why** would a **blow** from this be **dangerous?**—(**Muscular power of hind-quarters.**)

(5) **Why are babies** carried about instead of being made to walk?—(Too weak.) If kangaroos are **provided with nursing pouches**, will the young be born strong or weakly?—(**Weakly.**)

STAGE III.—Character and Habits.

Telling.

(1) **The fore paws—**

(*a*) The fore paws are **used more as hands** than as feet.

(*b*) The kangaroo makes its **leaps so rapidly** that the **fore legs never seem to touch** the ground at all.

(*c*) The kangaroo **can hold** and hug **with its fore paws.**

(2) **When chased—**

(*a*) It can travel so fast that the **fleetest dog** can only **overtake** it **after a prolonged run.**

(1) (*a*) *Imitate* the **movements of the kangaroo** by bounding along on the two feet, dangling the hands out in front.

(*b*) *Declare* this to be **a deception**—the fore feet are used, but **too quickly** and lightly for the **eye to detect it.**

(*c*) *Tell* that when pursued by dogs the **favourite defence** of the kangaroo is to seize the foremost pursuer and **hold it beneath the water** till it is drowned.

(2) (*a*) *Measure* fifteen to twenty feet along the floor to give an idea of **length of leap.**

Objects and Apparatus.—Picture of Kangaroos; Pictures of other Marsupials.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*b*) The kangaroo is a gentle and **inoffensive creature.**	Telling.	(*b*) *State* that it is not only an herbivorous creature, but it **occasionally ruminates**—and **all cud-chewers** are far from ferocious.
(*c*) Yet when it **turns to bay,** it can **tear open** its enemy with one stroke of its hind foot.		(*c*) *Describe* the **wound** inflicted by the sharp claw to be a **cut as cleanly** made as if done **with a knife.** *Say* that **dogs learn to dread the attacks** of so powerful a quarry which has a weapon that rips them open, or a defence which deliberately drowns them.
(*d*) It has **cunning** enough, too, to try **to break the scent** by great **side leaps.**		(*d*) *Recall* a similar **trick** of the hunted fox **to throw hounds off the trail.** *Describe* how the dogs are **likely to miss the scent** at a wide break in it.
(*e*) The **female,** which is smaller, is more **timid** than her mate, and seldom gives a good run **when chased.**		(*e*) *Tell* that the **doe** has been known to **lie down,** after being chased but a short distance, and **die of actual fear.**
(3) **Uses**—		
(*a*) The kangaroo is **hunted** both **by the natives** of Australia and also by the **colonials.**		(3) (*a*) *Briefly explain* **who** these different **hunters are.** *Say* that the **natives** kill by throwing the **boomerang,** or by surrounding and hurling **spears.** *Say* that the **colonials** hunt with fine **English dogs,** after the manner of fox-hunting. *Allude* again to the **rough handling** which the hounds sometimes get.
(*b*) The flesh is sometimes eaten as a kind of **venison.** The **fur** is held in estimation.		(*b*) *By questions discover* what we ordinarily **mean by venison.** *Mention* that **kangaroo tails** are larger and superior to ox tails for **soup-making.**
STAGE IV.—Recapitulation and Additional Information.		Recapitulate to review main points in the Lesson. It may then be added—
(1) The **varieties** of the kangaroo are **numerous.**		(1) *Name* the one here dealt with as the Great Kangaroo—**the largest animal found in Australia.**

(2) **All** the animals of **Australia seem peculiar** to our ideas.
(3) There are **various sorts of pouched animals,** but all belong to Australia **except one.**

(2) *Instance* the **duckbill** and the Echidna or **Porcupine Ant-eater.**
(3) *Instance* the **koala** of New South Wales—the **exception** being the Virginian **opossum of America.**

A Kangaroo.

VI.—SEAL

Objects and Apparatus.—Pictures of Seal, of Walrus, and of Whale ; Seal-skin.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictured Seal.		
(1) The seal is a **sea-animal** with a long body **tapering** from the chest **to the tail.**	Observation.	(1) *Point out* that it is a **fur-covered** animal with **four limbs,** and yet very much of the **fish-form.**
(2) The **head** resembles that of a short-muzzled dog.		(2) *Note* a gentle **dog-like** expression of feature.
(*a*) The **lips** are furnished with long stiff whiskers.		(*a*) and (*b*) *Direct attention* to these **features.**
(*b*) There are no external **ears.**		
(3) The limbs are **flippers.**		(3) *Compare* to oars or **paddles,** yet **a little more of a walking limb than that of a whale** (which is distinctly not a mere fin).
(*a*) The **fore limbs** are little more than paws sticking out from the body.		(*a*) *Note* short fore-arm, and the **five fingers** with **flat nails.**
(*b*) The **hinder limbs** are directed backwards, and each foot consists of **five toes webbed,** the central toe being the shortest, and the outer one on each side the longest.		(*b*) *Note* great **strength of bone** indicated—if shown out of action it will be noted that the **toes are folded ;** if shown in action that they are **spread** to present a broad surface. *Note* **trailing** position.
(4) The seal has a covering of **thick fur** closely set to the body.		(4) *Exhibit* a piece of **seal-skin** for examination. *Mention* the **natural colours** (yellowish grey and brown). *Note* how the **glossy hairs** are adpressed against the skin.
(5) The **tail** is short, and placed between the hind paws or flippers.		(5) *Point out* that the **tail appears superseded** by the hind limbs **as a swimming organ,** and particularly as a powerful and **quick steerer.**

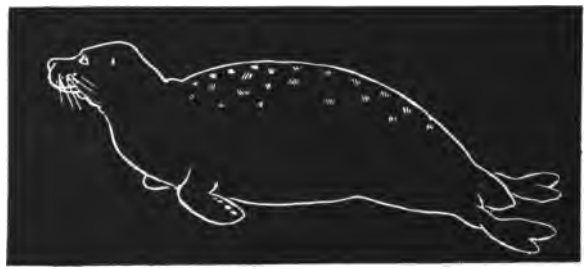
STAGE II.—Questioning on Foregoing Examination.		
(1) The seal is a **warm blooded animal** which lives most of its **life in the sea.**	Questioning.	(1) *Infer* from its **fur covering, and its four limbs,** that it is an animal, and therefore **warm blooded.** *Infer* from its **fish-like form,** and fin-like **flippers,** that it is a good diver and **swimmer.**
(2) It has a **warm covering** to suit a life in **cold water.**		(2) *Question* on the **close setting** of the fur—suited for wetting. *Question out* the fact that the **whale,** another sea-animal, **has blubber** under its skin as a protection against the cold.
	Telling.	*Tell* that the **seal also** has blubber under its skin, so is **amply protected.**
(3) It is an **excellent diver and swimmer,** and lives entirely upon **fish.**	Questioning.	(3) If an animal **lives** almost entirely **in the sea,** what may we expect it to **feed upon**?—(Fish.) If it feeds on fish, what **must it be able to do** in order to catch such **prey**?—(Dive and swim well.) Why is the seal furnished with **such powerful swimming and quick-turning limbs**?—(To chase and overtake fish.)
(4) While an **excellent swimmer,** it is but an exceedingly **awkward walker.**		(4) Do the **limbs point** downwards like legs, or **backwards like fins**?—(Like fins.) Suppose a **boy** lies on his stomach, and **tries to move** forward without bringing any one of his **four limbs underneath,** what kind of a movement will he be able to make?—(**Awkward flopping and hobbling movement.**)
	Telling.	*Compare* to a boy **hobbling along on his wrists**—moving the limbs **outwards and backwards.** *Tell* how seals keep **near the edge** of the ice or piece of rock, and after a few awkward wriggling flops **dive silently and gracefully** into the water.
STAGE III.—Structure and Habits.		
(1) The whole **form and structure** of a seal **suits** it to a **life in the sea.**	Questioning.	(1) *Review* (*a*) fish **form**; (*b*) flipper **limbs**; and (*c*) its well **protected** body.
(2) The **jaws** are very strong, and the **teeth** are sharply pointed.	Telling.	(2) *Describe* how **fiercely** the seal will **chase its prey** in the sea, as a tiger does on land, the prey consisting of fish and other marine creatures. *Infer* the necessity for **strong teeth and jaws** by the requisite rapid snapping and **spearing of the prey.**

SEAL—*Continued*

Objects and Apparatus.—Pictures of Seal, of Walrus, and of Whale; Seal-skin.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) When diving, the **nostrils** close tightly of themselves to **exclude the water.**		(3) *Explain* that there is a kind of self-acting **valve which closes as the animal dives;** And that the animal can keep **submerged a long time**, for the **blood** does **not** become **impure** for the want of fresh air.
(4) The seal averages five feet in **length.**		(4) *Say* almost the length of a man—that is, the **common seal**; for there are various kinds.
(5) The seal **comes occasionally to land**; it is **gregarious**, and frequents the recesses and caverns of our northern shores.		(5) *Explain* that they live in **flocks**—that they occasionally come to shore **to bask** in the sun, or **to suckle** their young.
STAGE IV.—The Fur Seal.		
(1) The fur seal is the most **valued**, and is **cultivated** in the islands of Alaska.	Telling.	(1) *Explain briefly* that Alaska is **a cold region** of North America. ,, ,, that **very strict laws** are in force to **prevent exhaustion** of the seal fishery.
(2) The **male** is full grown at six years of age, and then measures seven or eight feet in length.		(2) *Compare* with size of our common seal. *Tell* that the **old males** arrive at the grounds first, about April.
(3) The **breeding grounds** are called rookeries. (*a*) The seals take up a position on **a belt of loose rocks** between high water-mark and the base of a cliff. (*b*) Each seal selects **a special rock** of its own. (*c*) By July all the **females** have arrived; the **young** are reared, and taught to swim.		(3) *Describe* how the **natives** of these islands **extinguish all lights**, and keep everything quiet, so as **not to disturb** the seals; how valuable is the **seal fishing**, and how armed **ships protect it**, so that the seals may breed, and **not be killed** off **indiscriminately**. **Hundreds of thousands** are found living together at these breeding grounds. Each mother generally has **two cubs.**

(4) Only the **males are killed,** those about three years old yielding the best skin.		(4) *Describe* how the natives **cut off the retreat** to the open sea; then **allow to escape** those not wanted, and **slaughter** the others.
STAGE V.—Recapitulation and Additional Information. (1) The **walrus**, with its two great tusks, is a kind of seal. (2) The seal is said to have **so fine a sense of hearing** as to be attracted by musical sounds. (3) **Seal-skin** is amongst the most **valuable** of furs.	Telling.	*Review* by recapitulation. Then may be added— (1) *Note* the size and **formidable tusks**—the walrus does **not fly from man** as the seal does. (2) *Quote* Scott— "Rude Heiskar's seals, through surges dark, Will long pursue the minstrel's bark." (3) *Estimate* the **value** of a lady's seal-skin cloak at about £40 or £50. *Note* that the **Esquimaux value every kind** of seal, using skin, blubber, and other parts.



A Seal.

VII.—THE EAGLE

Objects and Apparatus.—Picture of Eagle (Golden Eagle and other varieties); Pictures of Falcon, Hawk, and Kite (to same scale, for comparison), and of Owl and Vulture (for contrast).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictured Eagle. (1) The eagle is a large, powerful, and **noble-looking bird.** (2) The **golden eagle** has a plumage of rich brown, tinged with a paler orange brown, which in a strong sunlight wears a "golden" appearance. (3) The **tail** is greyish brown, and nearly square. (4) The **legs** are feathered to the toes. (5) The **beak** is nearly straight for some distance from the base, then suddenly hooks; it is sharp and strong. (6) The **claws** are also sharply pointed and boldly curved. (7) The **eye** is bright and piercing.	Observation.	(1) *Admire* the combined **strength and beauty** of its structure. *Discover* that its noble bearing has won for it the title of "**king of birds.**" (2) *Note* that there are **various kinds** of eagles—the golden eagle is found in the Highlands and **occasionally in England.** *Call attention to* the hackled or **lanceolated feathers** on back of head and neck. (3) *Mention* that **another kind** of eagle has its **tail** coming to a point, **wedge-shaped.** (4) *Mention* this as a **characteristic of all eagles.** (5) (6) *Examine* **beak and talon** — *infer* **uses** from pronounced **structure.** (7) *Connect* **its bold glance** with its fanciful title of **kingship.**
STAGE II.—Questioning on Foregoing Examination. (1) The eagle is called the **king of birds.** The golden eagle is **sometimes met with in England.**	Questioning.	(1) **Why** is the eagle called the **king of birds?**—(Its noble form, fearless look, and great strength.) **Which kind** of eagle is sometimes met with **in this country?**—(Golden eagle.) **Why** is it called the **golden eagle?**—(From its yellowish-brown plumage, which appears golden in the sun's rays.)

(2) The **plumage** has a rich appearance; the **legs** are feathered to the toes; the **tail** is square-ended.

An Eagle.

(2) *Question fully* on **plumage**, as observed from pictures, particularly the **powerful wings**.
Differentiate **characteristics common** to genus Aquila (feathered **legs**), and **those peculiar** to a variety (**tail** shape).

An Owl.

EAGLE—*Continued*

Objects and Apparatus.—Picture of Eagle (Golden Eagle and other varieties); Pictures of Falcon, Hawk, and Kite (to same scale, for comparison), and of Owl and Vulture (for contrast).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) The **eyes** of the eagle are very strong, and are overshadowed by projecting **eyebrows.**	Questioning.	(3) **When we look** up at the **glaring sun,** what happens to our eyes?—(**Eyes water**—are dazzled, and blink.) If the **eagle** is in the **habit of soaring up,** even in face of a **blazing sun,** what kind of eyes must it have?—(Strong.) **Why do birds** need to rise so **high in the air?**—(To **see food** afar—perhaps to pounce on it.)
(4) The eagle is a **bird of prey;** the **talons** are used in the capture and killing, and the **beak** in the tearing of the flesh.	Memory. Comparison and Telling.	(4) **From** the size, strength, and shape of the eagle's **beak and talons,** what kind of a feeder should we expect it to be?—(**Flesh-eater.**) If the eagle looks strong, swift, and bold enough to **capture its own meat,** what shall **we call it?**—(**Bird of prey.**) *Question* on **structure and uses** of such **beaks and talons.** *Review by questions* the **automatic action** of the toes of **poultry**—how they close when lifted and bent for walking, or when the leg is bent for perching. *Compare* with similar action in legs of the eagle—which carries off its prey alive, bearing it **to the rock** on which it lives—**without loosing its hold it sinks** upon the prey with the whole weight of its body—as **legs bend,** their muscular power closes and **drives the sharp talons into the heart** of the victim, the eagle **screaming all the time** with fierce pleasure.
STAGE III.—Structure and Habits. (1) The eagle **preys upon** the larger birds, game birds, hares, lambs, and young deer.	Telling.	(1) *Lead up to, and question upon,* **its quarry.** *Mention* that instances are known of **babies being carried away** by eagles—the Earl of Derby's coat-of-arms has "the eagle and child."

(2) The **structure of the eye** enables an eagle to see equally well either **near or at a great distance.**

Contrast.

(2) *Explain* this as **common to most birds of prey**—*infer* **the long range** over which they hunt.

Explain that in soaring, the **eye** of the eagle is **really protected** from the sun by the **projecting eyebrow,** and that the poetical idea of "gazing fearlessly at the sun" is false.

Set against **the breakdown of this poetical fallacy** the two following *contrasts*:—

(i.) The **eagle** hunts boldly in the **day time,** whereas the **owl** hunts stealthily at **night.**

(ii.) The **eagle** captures and kills **living prey,** whereas the **vulture** eats **carrion.**

A Vulture

EAGLE—*Continued*

Objects and Apparatus.—Picture of Eagle (Golden Eagle and other varieties); Pictures of Falcon, Hawk, and Kite (to same scale, for comparison), and of Owl and Vulture (for contrast).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) (*a*) Eagles generally **hunt in pairs,** one watching from some height while the other courses along the ground.		(3) (*a*) *Describe* the attack as a "**rush**" rather than "a pounce."
(*b*) The male and female remain together all the year, and very **often mate for life.**		(*b*) *Contrast* with **gregarious habits of poultry.**
(4) (*a*) The eagle makes its **home** in the heart of some **wild region.**	Telling.	(4) (*a*) *Infer* its scarcity in **thickly-populated England.**
(*b*) The **nest** is always made on rocks, generally on some precipitous ledge; the nest consists of a mass of rough sticks and branches, and the place is called an **eyry.**		(*b*) *Paint* the spot selected as **inaccessible** to the most venturesome **cragsman.** *Derive* "eyry" from "**eggery.**" *Tell* that the **eggs** are two in number, of yellowish white with brown blotches.
(*c*) The **eaglets** are fledged about the end of July, and are soon afterwards taught the **manœuvres of flight** by the parent birds.		(*c*) *Describe* this sublime exercise: the offspring are **first taught to rise** from the mountain top in the eye of the **mid-day sun**—at first **small circles** are made for the young to **imitate**—then a larger gyration—the **circles of flight** being enlarged so as to make a gradually **ascending spiral**—till the **birds** become a **mere point** in the air.
STAGE IV.—Recapitulation and Additional Information.		*Review by recapitulatory questioning* for main points of the Lesson.
(1) Wales, Derbyshire, Cumberland, and Westmoreland, **once boasted their eyries.**	Telling.	(1) *Quote:* "The tawny eagle sits his callow brood High on a cliff, and feasts his young with blood; On **Snowdon's** rocks, or **Orkney's** wide domain, Whose beetling cliffs o'erhang the western main."

(2) The strength of limb, power of flight, and proud triumph over prey, have made the eagle **a symbol of the conqueror** in all ages.	(2) *Tell* that the great or imperial eagle was called "**the chief magistrate of the birds**" by the ancient Greeks; the "**eagles**" were the "flags" which led the ancient Romans to their victories in conquering the world—the eagle was the **omen of victory.** Amongst **modern nations** the eagle is adopted as a **symbol** by France and by the United States of America—(*show a coin with the eagle on it*)—and the **Red Indian** "brave" decks his brow with an **eagle plume** as the highest form of ornament.

VIII.—OWL

Objects and Apparatus.—Picture or Stuffed Specimen of White or Barn Owl; Picture of Brown Owl, Great-Eared Owl, and others (to same scale, for comparison).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictured or Specimen Owl.		
(1) The owl is a bird which has **a great round staring face.**	Observation.	(1) *Arrest the attention* by presenting for notice the **peculiar features** of the owl, *noting* its flat round **face formed by a disc** of feathers, and its **round staring eyes.** *Show* its **resemblance** to a grotesque ("funny") **human face,** and its **divergence from** the ordinary peaked **type of bird features.**
(2) The **head** is large, the **wings** are large, and **plumage** is so thick and soft that the bird **looks larger than it really is.**		(2) *Bury the fingers* in the **thick soft feathers**; or, if no specimen be present, describe verbally this thickness and softness of the **fluffy** plumage.
(3) The common white or **barn owl** is more than a foot in length; it is of **a pale colour**—white tinged with buff.		(3) *Note* **power of flight** indicated by **large wings.** *Indicate size* of bird with the hands held fourteen inches apart, if no specimen be available.

OWL—*Continued*

Objects and Apparatus.—Picture or Stuffed Specimen of White or Barn Owl; Picture of Brown Owl, Great-Eared Owl, and others (to same scale, for comparison).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		Name this as the **commonest** of owls; but *caution* against the descriptive force of the word "**white**"; (i.) the **full-grown male** has the **lower surface** of the body quite white, but the back and wings are soft buff, speckled with black and white; (ii.) the **young males and females are pale fawn below**, instead of white.
(4) The **beak** is strong, the upper one being curved and sharp. The **talons** are very curved, sharp, and highly retractile.	Comparison.	(4) *Examine* these features, *and infer* the "**bird of prey.**" *Compare* the **retractile claws**, "going in and out of sheaths," with those of the **cat.**
STAGE II.—Questioning on Foregoing Examination. (1) The **eyes** of the owl are set in **front of the head**; the **sight** is adapted for **nocturnal habits**, and can be **adjusted** for distance.	Questioning.	(1) *By questioning continue comparison* from previous stage, *to elicit* first that both owl and cat possess a pair of **round gleaming eyes** set in **front of a rounded head.** *Then discover* that **both can see at night** in the smallest amount of light. *Compare* **use** of owl's eyes to the use of a "**spying-glass**"—only objects **in front** are seen, and the sight has to be adjusted or **focussed for distance**—both eyes are brought to bear on same object. *Discover* that if the owl **cannot turn the eyes round**, the head as a whole must turn round—which it does, till the **head can look right over the tail**; *contrast* with mobility of **our sight**, and *demonstrate* the limited "sweep round" allowed by **our neck joints.**

(2) The **ears are concealed** close behind the eyes; they can be freely used, and the **hearing is very acute** for night hunting.	Supplemented by Comparisons and Telling.	(2) If one **hunts by night**, however good the sight may be, which **other sense** will prove a great aid?—(**Hearing.**) Though **no ears can be seen** on the owl, is it likely or unlikely to have **good hearing?**—(**Likely.**) *Tell* that ears are holes or **orifices hidden between two large valves**, from the edges of which proceed the feathers forming the outer ring of the face disc; that the valves **can be opened** to catch **the slightest sound.** *Exhibit* by opening the concealing feathers on any available specimen.
(3) The **plumage is soft** and fluffy, to **afford a noiseless approach** to the prey.	,,	(3) *Comparing further* with the **cat**, *elicit* that night hunters approach their prey **stealthily**. *Hence discover* use of soft fluffy plumage—**noiseless approach does not disturb** the prey. *Tell* that not only are body feathers loose and soft, but the **quill feathers** offer no ridges to **resistance of the air.** *Compare* the flight to that of **thistledown.**
(4) The **wings** are large and powerful.	,,	(4) Is all this **thick covering** likely to aid or to **hinder flight** through the air?—(Hinder.) Then **ought wings** to be more or less **powerful to make up** for this?—(More powerful.)
(5) The owl **preys** on such small **creatures** as come out in the **twilight** and **night-time.**	,,	(5) If strong light **dazes the eyes** of the owl, when will it be able to **come out** for hunting its prey?—(**Twilight and night.**) Name some small **creatures that come out at such times?**—(Mice, young rats, voles, shrews, beetles, and small birds.)
STAGE III.—Structure and Habits of the Barn Owl.		
(1) Owls live **close to houses**, but in such **safe retreats** as ruined buildings, church towers, and hollow trees.	Telling.	(1) *Show* that although **preferring** to live in the **neighbourhood of man**, because of his **attraction of the vermin** on which they live, owls **select** retreats in which they are **undisturbed in the daytime.**
(2) They are **friends to the farmer.**		(2) *Prove* this by the **vermin they destroy**; and by the fact that where all the owls have been shot, voles have **become** quite a **plague.**
(3) As owls have **no crops**, and swallow their prey freely, the **indigestible portions are rejected** from the stomach, and then ejected from the mouth as **small pellets** (*rejectamenta*).		(3) *Refer* to beak and claw **tearing flesh** of victim. *Then ask* for names of **untearable parts** of the prey—bones, feathers, beaks, claws.

Objects and Apparatus.—Picture or Stuffed Specimen of White or Barn Owl; Picture of Brown Owl, Great-Eared Owl, and others (to same scale, for comparison).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(4) The **nest** is made with a **mass** of disgorged **pellets**; three or four **eggs** are laid, and as the **owlets** are fledged the hen sometimes commences to **sit another clutch of eggs**.	Telling.	(4) *Tell* briefly. *Explain* difficult terms.
STAGE IV.—Recapitulation and Additional Information.		In recapitulatory *review*, *the main points to bring out* are—
(1) The owl is specially **adapted by structure to nocturnal habits.**	Questioning.	(1) *Question on* (*a*) soft non-rustling **plumage**; (*b*) nocturnal **sight**, with strange **adjustable** focus and **pivot** movement of the **neck**; (*c*) acute **hearing** worked by **valves** in hidden orifices.
(2) Seems specially **serviceable** in maintaining the **balance of nature.**		(2) *Question on* (*a*) the **vermin it destroys**; (*b*) its consequent **use to agriculture**, and the **destruction** of the **balance in nature** where it is wilfully **exterminated**; (*c*) noting its **peculiar** habit of **disgorging pellets** of indigestible food.
(3) Among birds **corresponds strangely to the cat** among mammals.		(3) *Recall* points of **resemblance**: (*a*) **nocturnal** habit; (*b*) adjustable **eyes**; (*c*) quick **hearing**; (*d*) soft covering for **stealthy** approach; (*e*) **vermin-killing** usefulness.
	Telling.	*Add* that owls, like cats, **fight** desperately lying **on their backs**, using **claws**, and **hissing** with spite and anger.
(4) The barn owl is sometimes called the **screech owl** on account of its cry.		(4) *Distinguish* from the **brown** or tawny **owl**, the fierce little bird which "**hoots.**"
(5) The owl is the **symbol of wisdom.**		(5) *Draw attention* again to the resemblance of the owl's features to a grave and learned **human face**—dub the owl "**the bird of wisdom,**" and *mention* that **Minerva, the goddess of Wisdom,** was generally represented with an owl.

IX.—SWALLOW

Objects and Apparatus.—Pictures or Stuffed Specimens of Swallow, Swift, House Martin, and Sand Martin.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictured or Stuffed Swallow.		
(1) The swallow is a bird seen **flitting about in the summer time.**	Observation.	(1) *Recognise* its **familiar** form; *associate* **darting flight** and **summer days** with its presence.
(2) The **Common Swallow,** or Chimney Swallow, in **form**—		(2) *Say* we shall note several **varieties** in this group.
(*a*) Is a **slender** little bird.		*Note* all features indicate **lightness of body,** and **power of swift** and sustained **flight**—the **tail** is about **half** the length of **entire bird.**
(*b*) With **wings** very long and **pointed.**		
(*c*) **Tail** also long and **forked.**		
(3) **Plumage**—		(3) *Point out* severally, and *note* for future recognition of these **markings.**
(*a*) Forehead and throat has **brownish-red** feathers.		
(*b*) Head, neck, and back has **glossy bluish-black** feathers.		
(*c*) Wings and tail feathers are **brownish-black,** with a **little white** on inner side.		
(4) The **gaping bill** is short, flat, and triangular, furnished at the base with **short bristles.**		(4) *Note* distinguishing feature—"**cleft**" or gaping **bill.**
(5) The **legs** are short; the **toes** have strong, sharp, curved **claws.**		(5) *Note* evident **weakness** in **walking** power—but formation **for clinging tightly.**
STAGE II.—Examination of Other Varieties of the Swallow Group.		
(1) The **Swift**—	Observation.	(1) *Compare* the very long **stiff wings** of the "**screecher,**" as the black swift is called from his harsh scream, to **scythe blades.**
(*a*) Is the **largest** of the swallow tribe.		
(*b*) Has its **tail** but slightly forked.		

SWALLOW—*Continued*

Objects and Apparatus.—Pictures or Stuffed Specimens of Swallow, Swift, House Martin, and Sand Martin.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*c*) Has all **four toes directed forward,** and covered with **small feathers.**		(*c*) Notable feature.
(2) The **House Martin**—	Observation.	(2) *Arrange* all four **according to size,** and the **order** will be Swift, Swallow, House Martin, Sand Martin.
(*a*) Is **smaller** than the swallow.		
(*b*) Has a **tail** shorter and less forked.		
(*c*) Is **destitute of the chestnut marks** which distinguish the swallow.		
(*d*) Has its **legs** covered with **downy feathers.**		
(*e*) Is always distinguishable by **the white patch on its back.**		(*e*) Distinguishing **badge.**
(3) The **Sand Martin** is the **smallest** of the swallow tribe.		(3) *Remark* on **apparent weakness** for scooping out hard sandstone; yet the **bill is hard and pointed,** and useful for work as a tiny **pick-axe.**
STAGE III.—Questioning on Foregoing Examination.		
(1) The swallows or martins **vary** a little in **size,** and slightly in **form and colour.**	Questioning.	(1) *Elicit* **respective sizes,** ranging from large Swift to small Sand Martin. *Elicit* divergences in **form,** and differences in **colouring**; dwelling on the **distinguishing marks.**
(2) All of them are **built lightly,** and with great **power of wing.**		(2) *Contrast* evident weakness of **legs** with powerful **wing** development. *Compare* measurements of **body** with those of **wings and tail.** *Infer* power of **sustained flight,** and a **life** spent almost entirely **on the wing.**
(3) They belong to the **perchers.**		(3) *Inquire* **who ever saw** a swallow **walk on the ground,** or alight anywhere except in clinging near its nest?

(4) Swallows belong to that class of perchers **distinguished** by their "**wide gaping**" **bills** (*fissirostres.*)

A Swift's Beak.

(4) *Recall* the **various bill formations**; as the "cone bills," like the finches; the "tooth bills," like the thrushes; the "slender bills," like the wren; and now "**the cleft-billed swallows.**"
Note **triangular shape**; the width and **extent** of the wide-opening mouth; and *infer* the habit of **catching flies** on the wing, which could **not** easily be **accomplished** if the **beaks were narrow** and opened but slightly.
Elicit the use of the **bristles** in preventing **escape** of the flies once within this **living fly-trap.**

STAGE IV.—Habits of the Swallow.

Telling.

(1) The swallow—
- (*a*) Spends most of its life **on the wing.**
- (*b*) It is seen in **rapid flight early and late.**
- (*c*) It feeds entirely on **insects**, which it **catches on the wing.**
- (*d*) It can also **drink while sweeping along** surface of the water.
- (*e*) And can even **collect materials** for its nest **whilst flying.**

(1) *Dwell* a little on these **marvellous powers of flight.**
Infer the **keenness of eyesight** to perform all this work so rapidly without accident.

(2) The swallow is a **bird of passage,** arriving in England in April, and leaving in September.

(2) *Explain* briefly the habit of **migration.**

(3) The **nest**, built soon after its arrival—
- (*a*) Is cup-shaped, fixed in chimney or on outhouse.
- (*b*) Of **mud and dirt,** mixed with short straws, and lined with feathers or grass.
- (*c*) Shelters **two broods,** one about June and second about August.

(3) *Claim* **England** as the bird's **real home** (not the "sunny south" to which it migrates in search of insect food when winter keeps our insects dormant), because it is the birth-place, or "**native**" **land.**

(4) The male swallow is a **songster,** but its note is **very weak.**

(4) *Tell* that it has chirps and twitterings, and always gives a loud **alarm-note** on the appearance of a **hawk,** to send the **other birds into hiding.**

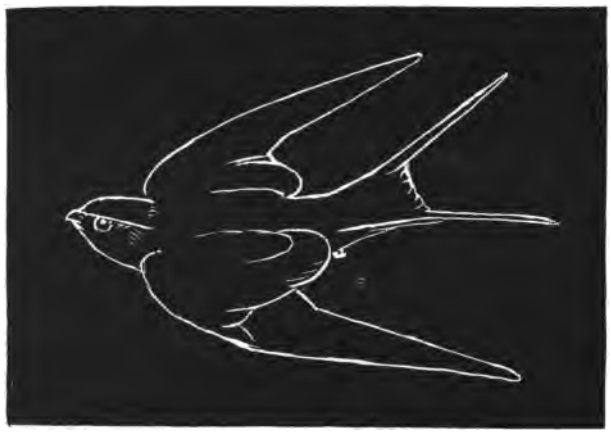
SWALLOW—*Continued*

Objects and Apparatus.—Pictures or Stuffed Specimens of Swallow, Swift, House Martin, and Sand Martin.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE V.—Habits of other Three Members of the Swallow Tribe.		
(1) The **Swift** —	Telling.	
(*a*) Is the **last** of its tribe to **arrive here**, and the **first to depart.**		(1) (*a*) *Distinguish* as the **most active** of its tribe—infer **appropriateness of its name**, "swift."
(*b*) Is in **working flight** from **early** morning to **late** in evening.		(*b*) *Teach* to **detect** swifts, even at the **enormous heights** to which they soar, by their very long narrow pointed wings, **looking like a narrow crescent.**
(*c*) Makes a **rude nest** in holes of walls, or in church towers.		
(2) The **House Martin**—		
(*a*) Arrives **later than the swallow**, about May.		
(*b*) About September perches on houses and trees in **great numbers preparatory to departure** south.		
(*c*) Builds **a nest of clay** under the **eaves** of some **friendly house.**		(*c*) *Distinguish* its **nest** from the swallow's by its **top-covering.** *Tell* that a pair often take possession of **same nest** for several **successive seasons.** *Note* **appropriateness** of name, "**house**" martin.
(3) The **Sand Martin**—		(3) (*a*) *Note* **appropriateness** of name, "**sand**" martin. *Call to mind* their **burrows** in railway cuttings and sand pits.
(*b*) Lays its **tiny eggs on a simple nest** of feathers or hay.		
STAGE V.—Recapitulation and Additional Information.		Recapitulate chiefly for **distinguishing marks and characteristics.**
(1) Swallows are peculiarly **summer birds**, coming only when **insect life is rife here.**	Telling.	(1) *Quote* "two swallows do not make a spring," and *explain* the saying. *Dub* them "**insect chasers.**" Allude to the **goatsucker** and the **bat,** insect feeders at **night-time.**

(2) Although in **one group,** these four show **great diversity in nest building.**

(2) *Recall* that swallow and house martin fasten their **cup-like nests** of mud against the **walls of our houses,** the latter being covered in above; the swift making scarcely any **nest deserving of the name;** and the sand martin **burrowing** in the soft stone. *Add* an allusion to the **jelly-like nest** of the Java swallow, **eaten** as a delicacy by the Chinese.



A Swallow (Flying).

The Forked Tail of a Swallow.

X.—SWAN

Objects and Apparatus.—Picture of Swan and Cygnet ; a Powder-puff.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictured Swan.		
(1) The swan is the **largest** of the **swimming birds.**	Observation.	(1) *Recall* lessons on the **duck** and the **goose.** *Compared* with goose it is "about **twice the size**"—*discard* actual figures "length 60 inches, weight 30 lbs."
(2) The **plumage** is pure **white.**		(2) *Remind* that geese and ducks have **other colourings.** *Add* that a "**black swan**" was thought to be a **myth,** till such were discovered at Swan River in Australia.
(3) The **bill** is reddish orange, the **legs and feet** are black.		(3) *Compare* with **duck.** *Remark* that while the **tame duck** always has **yellow feet,** the **wild duck** always has **black feet ;** and the **tame swan** is distinguished by its **red bill,** which has a **black knob** at the top of it.
(4) The swan is the most **graceful** of creatures when **swimming.**		(4) *Suggest* that **pictures** invariably **depict** the swan as we prefer to see it—**swimming.** *Admire* its graceful **curved outlines.** *Point out* that a swan is even far **more graceful** than a swimming **duck or goose.**
STAGE II.—Questioning on Foregoing Examination.		
(1) The swan is a large and **powerful bird.**	Questioning.	(1) What other **bird** do you know **larger than the swan?**—(None.) What **weapon** of defence is the swan **provided with?**—(None.) What **limbs** has it?—(Two wings and two legs.) With which could it **strike a powerful blow?**—(Wings.)
(2) It is so graceful that it is **kept for ornament.**		(2) *Question* on the **observed facts** relating to its **form and colouring.** *Ask* who ever heard of swans **working** for man, or **providing** him with **food ;** then **why** are swans **kept?**—(To ornament rivers and lakes.)
(3) Swans are generally kept where they can **find their own food.**		(3) **Where** do ducks, and more particularly geese, like to **find much of their food?**—(On the land.) But where are **swans in-**

		variably seen?—(**On water.**) Then where must they **find their food?**—(**In the water.**) Try to **name** some of the things **swans find to eat?**—(Seeds, roots, water plants, frogs, insects, worms.) Who **like to feed** the swans?—(**All children.**) *Note* that swans are really **vegetable feeders.**
STAGE III.—Habits of Tame and Wild Swans. (1) The tame (or mute) swan is a **semi-domestic** bird.	Telling.	(1) *Lead on* from the previous stage *to discover* that— (i.) The swan is domesticated, inasmuch as it dwells **near our houses.** (ii.) The swan is a wild creature, inasmuch as it **finds its own food and shelter.**

A Swan.

SWAN—*Continued*

Objects and Apparatus.—Picture of Swan and Cygnet; a Powder-puff.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) The **wild** (or whistling) **swan visits our coasts** in the winter.	Telling.	(2) *Tell* that the wild swan is called the **whooper**, or whistling swan, and comes from the **cold north**; it is **not so heavy** a bird, and its **neck is shorter**; it nested in the **Orkneys** at one time. *Describe* the **cry** of the wild swan as "Hoop! hoop!"—harsh when heard near, but **musical high up in the air.**
(3) Swans (*a*) live in **societies.** (*b*) **Swim** rapidly. (*c*) Have powerful and long continued **flight.**		(3) (*a*) *Note* **gregarious** instincts and social habits. (*b*) *Note* **ease, grace,** and **majesty** of movement. (*c*) *Indicate* eight feet to show stretch of **outspread wings.** *Tell* that a **blow** from a swan's wing is **terrific**—that a swan can easily **beat off** the attack of **an eagle**—that it **hisses when angry**, as a goose does. *Illustrate* power of **sustained flight** *by telling* that— (i.) Wild swans which visit our coast **fly from Iceland** and northern extremities of Europe. (ii.) Tame swans **sometimes take flight** to some neighbouring water which they find more suitable.
(*d*) **Moult** once in each year, and attain a considerable **age.**		(*d*) *Note* that both male and female have **same white plumage.** *Explain* that in moulting they **shed** all their flight quills at once—that wherever the natives have ruthlessly hunted the wild swans during this **period** of **helplessness**, they have **disappeared from that region.**
(4) The **nest**— (*a*) Of the **wild swan** is made of moss and peat. (*b*) Of the **tame swan** is made of reeds, rushes, and other herbage; placed near water's edge, or better still on some little island.		(4) (*a*) *Indicate* on the floor its **great size**—six feet long and two feet high, and a **cavity** big enough for a cradle. (*b*) *Describe* **eggs** as greenish-white, six or seven in number; the young are called **cygnets**, and are **bravely defended** by the male parent.

STAGE IV.—Recapitulation and Additional Information.		In recapitulatory questioning *bring out* that the swan is **ornamental rather than useful**. *Then may be added—*
(1) Most of the **swan's down** of commerce is procured from wild swans.	Questioning.	(1) *Enumerate* **uses**—for making tippets, trimmings, and very soft cushions.
	Telling.	*Estimate* that for ladies' **powder-puffs** alone, no less than 7000 swans' skins are used annually in London.
(2) Up to the sixteenth century no **state dinner** was complete unless a swan made one of the dishes.		(2) *Say* that the **meat** is dark and **coarse—no temptation** to breed such expensive birds **for the table.**
(3) The swan in England is called the **bird royal**, as no one is allowed to keep swans on any public river or piece of water except by grant from the crown.		(3) *Inform* that most of the swans on the **Thames** belong to the Queen, and have on their bills the **royal** swan mark, **five small nicks** notched on the upper part of the bill. That **others** on this river belong **to certain rich companies** of London merchants, one company marking with one nick, and the Vintner's Company with two nicks, and so on. That swans on **private waters** need not be marked, and that up to the sixteenth century every large estate had an extensive **swannery** attached to it.

XI.—SNAKE

Objects and Apparatus.—Pictures (or Preserved Specimens) of Snakes ; a Cup-and-Ball Joint (or Toy) ; Vertebræ Bones; a Piece of Gold-beater's Skin.

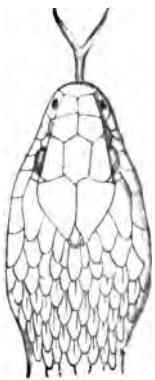
MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Pictures or Specimens.		
(1) A snake is a creature with a **long roundish body** and **without limbs.**	Observation.	(1) *Draw attention* to **absence** of legs, wings, fins, or other **limbs.**
(2) The **common** (Grass or Ring) **snake** is about a yard long.	„	(2) *Compare* with **length of other** snakes. (The common **viper** or adder is about **half the length.**)

SNAKE—*Continued*

Objects and Apparatus.—Pictures (or Preserved Specimens) of Snakes ; a Cup-and-Ball Joint (or Toy) ; Vertebræ Bones ; a Piece of Gold-beater's Skin.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) The **body** of a snake **tapers** and **can coil** up in any direction.	Observation.	(3) *Show pictures* of **coiled snakes.** *Coil* and twist some **flexible** round **body in imitation.**
(4) A snake has a **covering of scales**; the **markings** help to **distinguish** one kind of snake from another.	,,	(4) *Compare* with **scales** of a **fish.** *Contrast* with **coverings of fur** and feathers. *Distinguish* **markings: common snake** has a **yellow patch** on each side the neck, a **double chain** of dark **spots** running along the back, and a single row of larger spots along each side. **Viper** has two black stripes on the top of the **head** forming the **letter V** (initial of viper) and a **zigzag** of squared **black dots** down the middle of the back.
(5) The **scales** are **overlapping horny plates,** fixed in front, but with **free edges pointing backwards.**	,,	(5) *Compare* to **overlapping tiles** or slates. *Note* that the **scales on lower part** of body are **larger,** and generally made into **bands.**
(6) The **head** is **little** larger than the body ; the **teeth** point **backwards,** and the **tongue** is **forked.**	,,	(6) *Note* **tail-like** or whip-like **formation** of snake. *Note* **slender head.** *Note* that **teeth** are small, sharp, **pointed—none** for biting or **chewing food.**
STAGE II.—Questioning on Foregoing Examination.		
(1) The snake, having **no limbs, moves itself** along by **wriggling** its flexible body.	Questioning.	(1) How many **limbs** had the **earthworm?**—(None.) How did it **move along?**—(**Wriggled.**) To wriggle, and turn, and **twist in all** directions, what **kind of a body** is needed?—(Flexible, pliant, one easily bent.)
(2) The **loose edges** of its **scales** enable it to **hitch itself along.**	,,	(2) What had the **earthworm** on its **underside** to help its **forward motion?**—(**Hairs.**) What has the **snake** to project (**stick out**) backwards in **same way?**—(**Scales.**) What **kind of a surface,** a smooth or a rough one, is **better for a snake** to crawl upon?—(**Rough.**)

(3) The snake **swallows its prey whole.**	,,	(3) If the snake has **no teeth** for chewing its food, or even **for biting** it into **pieces**, how must it take its food?—(**Swallow it whole.**) Supposing the **prey were alive**, as it often is, and **struggled to escape**, how would the **snake's teeth prevent it**?—(Being directed backwards.) *Illustrate* the latter by any kind of trap or snare made on the same principle—**easy of entry**, and **difficult of return.**
STAGE III.—The Common Snake: Structure and Habits.		
(1) The common Grass or Ringed snake is the **largest found in England**, and is quite **harmless.**	Telling.	(1) *Compare* with **viper**, and with larger **foreign snakes.** *Discover* that **some** snakes are **poisonous**, and **some crush their victims** in their folds.
(2) The tapering **bony skeleton** has **ball-and-socket joints**, and thus enables the snake to **bend** its body **easily.**	,,	(2) *Exhibit* **vertebræ**, or ball-and-socket. *Illustrate* by action of our **shoulder joints**, and contrast with **hinge-joint** of our **elbows.** *Ask* if **flexibility** (easy bending) **requires long bones** and **few joints**, or the contrary?—(Short vertebræ and numerous joints.)
(3) **Each vertebra** bears **two ribs**, with the **under ends free**; these ribs **move backwards and forwards**, and the free ends act like little legs.	Questioning.	(3) *Contrast* with **our ribs**, joined in front by **breast-bone.** *Suppose* they were not joined, and that we crawled on our bellies, **these ribs** might be likened to a **series of little bow-legs.** **How** is it the snake's **ribs move** backwards and forwards **so easily?**—(Ball-joints of vertebræ.) **Why** is it we **cannot see** this **movement** of the snake's ribs?—(Hidden by scale-covered **skin.**)
(4) These **movable ribs**, covered by **scales**, become the **organs of locomotion.**	Telling.	(4) *Explain* how the **scales are moved forward** by ribs, how their free **edges catch** against any slight roughness, as the **snake draws the rest of his body** after him with a steady **gliding motion**, and so wriggles **along the ground** in a serpentine fashion. *Claim* that the snake thus **walks without legs, climbs without hands**, and can even **swim without fins.**



Head of the Common Snake, showing Scales.

SNAKE—*Continued*

Objects and Apparatus.—Pictures (or Preserved Specimens) of Snakes; a Cup-and-Ball Joint (or Toy); Vertebræ Bones; a Piece of Gold-beater's Skin.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(5) The snake **sheds its skin** at intervals, the entire coat coming off, even to the covering of the eyes.	Telling.	(5) *Explain* that this is accomplished by **entangling the loose skin** in some bush, and then **creeping out**, turning the cast skin **inside out like a glove** may be drawn off.
(6) Snakes are **able to swallow whole animals bigger** in diameter than their own bodies.	,,	(6) *Recall* that having **no** cutting, tearing, or **grinding teeth**, the snake swallows its prey whole.
(*a*) The **bones** of the **head** are merely **held together** by **elastic muscles.**		(*a*) *Explain* how the **bones** of the **head separate.**
(*b*) The **jaw bones** are jointed by **elastic membrane.**		(*b*) ,, ,, the two **sides** of the **lower jaw separate.**
(*c*) The **skin stretches** to four times its usual diameter at the neck.		(*c*) ,, ,, the **skin stretches** till it looks like **gold-beater's skin** (which *exhibit*).
(*d*) The **ribs open wide** to allow the gorged food to pass.		(*d*) ,, ,, the **swollen body** shows position of **gorged meal.**
(7) The **teeth are set inwards,** and snakes are **bound to finish swallowing** anything entering the mouth.	,,	(7) *Explain briefly* a forward and backward **motion of the jaws,** taking a **fresh hold** at each **gulp,** and pulling the **prey further in** each time.
(8) The long **forked tongue** is merely a **feeler.**	,,	(8) *Combat* notion of the **darted tongue** being a "**sting,**" or conveying **poison.**
(9) The common snake **lives near ponds** and marshy lands, and prefers to **prey** on defenceless **frogs.**	,,	(9) *Argue* that **venom** may be **required to overcome** resistance of strong **struggling prey**—but for frogs no poison-fangs are needed.
STAGE IV.—The Viper.		
(1) The viper is a **poisonous English snake,** about eighteen or twenty inches in length.	Telling.	(1) *Explain* that **two long teeth** in upper jaw have **poison sacs.** *Compare* with our **salivary glands.**
		,, that the **poison trickles down** these **hollow fangs** into the bite.

(2) Its **food** is mice and small birds.

(3) Its **home** is in some dry sandy situation.
(4) **Both** kinds of snake retire to holes and **sleep through the winter.**

,, that the **bite is not deadly** to a healthy person. (**Wound** should be **sucked.**)
(2) *Note* compensation to the **smaller snake**—it **has venom** to overcome the stronger prey.
(3) *Note* that **vipers dislike water.**
(4) *Note* that a **viper,** if disturbed **during winter,** has then a **harmless** bite.

An Adder.

XII.—INSECT MIMICRY

Objects and Apparatus.—Caddis-Cases, or at least Pictures of them, and the Caddis-Fly in each Stage of Life; Pictures or Specimens of as many Examples as possible of Protective Mimicry, and of Animal Defences generally.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Animals on the Defensive.		
(1) **Animals** have many **enemies.**	Telling.	(1) *Specify*—many are **devoured** as **prey**, some are **killed** as **noxious** creatures by man.
(*a*) They are therefore sometimes **armed**; or		(*a*) *Distinguish* weapons of **offence**, as horns, tusks, claws, poison fangs.
(*b*) At least possess some **means of defence.**		(*b*) *Instance* **shell** of snail, **spines** of hedgehog.
(2) **Small creatures**, particularly, are provided with such means; or their **extermination might result.**		(2) *Show* that being small and weak they **have need** of some defence to prevent their extermination. *Account for* their existence in **myriad multitudes** by their **wholesale destruction.**
STAGE II.—Insects, their Enemies and their Defences.		
(1) The **enemies of insects** are—	Telling.	(1) *Specify* some as—
(*a*) The **insectivorous** creatures.		(*a*) Bat, frog, fish, insects of prey (dragon-fly, lady-bird).
(*b*) Particularly **birds.**		(*b*) Swallows and swifts **by day**; night-jar **by night**; the shrike, which transfixes **hard beetles** on thorns; the rook, which **digs up** caterpillars; the blackbird, which unearths the cockchafer grubs, &c.
(2) The **defences** of insects are—	Questioning where previous Lessons are drawn upon.	(2) *Specify* some as—
(*a*) **Numerous** and various.		(*a*) **Hairy** caterpillars (rejected by birds, as hairy herbage is by cattle), **spines** that tear the mouth, a **disagreeable taste** (which saves the species after the sacrifice of a few individuals), an ugly or **threatening look**, the shooting out of **horns**, and various **devices to frighten foes.**
(*b*) But the **most remarkable** is that of **disguise.**		(*b*) *Instance* the case of a tasty insect, good to eat, assuming the **appearance** of a dangerous or an **ill-tasted kind**; thus flies and even moths (*Sesia apiformis*) try to look **like**

		bees and wasps, dreaded on account of their stings; similarly **ants** that have **no poison** imitate the appearance of those that have; a **butterfly** in Malaysia with **so evil an odour** that no bird will touch it, is **imitated** in **its heavy flight** by another tasty and odourless one; and in Assam there is a **caterpillar**, a tempting morsel to birds, but which it frightens away from it by the **erection of soft prickles** all over the body, till the grub **looks like a shrew-mouse**, the very creature which preys upon it most.
(3) **Most frequently** insects seek to **escape the notice** of their enemies by taking the **form or colour** (or both) **of surrounding objects.**		(3) *Instance* (for colour) **leaf-eating** caterpillars—they are **green**, and not easily seen on under side of leaf. *Instance* (for both) caterpillars of **geometer-moths**, common on trees, which are cunning enough to stick out from branches to which they cling, in form and colour **hardly distinguishable from twigs**; and if detected they drop suddenly and disappear, but are really hanging by a thread of silk, up which they will return to their old place when the threatened danger has passed. Among foreign examples—(i.) A **leaf insect** of Malay can scarcely be distinguished from the myrtle leaf upon which it feeds; and a similar leaf insect is found on orange trees; (ii.) Other insects closely **resemble rotten twigs**, the locust for instance putting up its legs when resting till it cannot be told from a dead stick.
STAGE III.—The Familiar Example of the Caddis-fly.		
(1) The caddis-fly is a **moth-like** insect with **four wings** and **two feelers**. (*a*) The **wings** are brown, grey, white, or mottled with all three. (*b*) The **wings** are gauzy and delicately veined or netted. (*c*) The **wings** when at rest are folded tent-wise over the body.	Observation.	(1) *Show specimens for examination*—the caddis is well known to **anglers** who use both larva (soft, fat, and white) and perfect insect for bait—can be found near streams in spring and early summer. At other seasons good *pictures* may suffice.
(2) The **life-history** of the caddis is not exceptional; and the **habits** of the perfect insect are not particularly interesting.	Telling.	(2) *Tell briefly*—the perfect insect has **one object in life**, the laying of its eggs, a little green cluster carried at the extremity of the body.

INSECT MIMICRY—*Continued*

Objects and Apparatus.—Caddis-Cases, or at least Pictures of them, and the Caddis-Fly in each Stage of Life; Pictures or Specimens of as many Examples as possible of Protective Mimicry, and of Animal Defences generally.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		Tell or recall habits as observed—seen over **surface of stream** and pond in **early summer**—fluttering or settling on waterside herbage—occasionally one crawls down stem of a water-plant, **disappearing beneath the surface** of the water to be snapped up perhaps by a fish—or it can even run **along the surface** of the water.
(3) The **chief interest** is found in the **grub-stage** of its existence:	Telling.	(3) *Connect* **aquatic** larva with water-frequenting **habits** of the perfect fly.
(*a*) Which is spent in the water in the midst of innumerable enemies.		(*a*) *Help class* to enumerate **foes**, as fishes, newts, beetles, dragon-fly larvæ.
(*b*) And although the front sections of the body (bearing its six legs) are clothed in stout armour, its **tail is entirely unprotected.**		(*b*) *Describe* this hinder part as a delicate **morsel eagerly sought** by many voracious foes.
(4) So a **protective case is constructed** for the tender tail—	Comparison.	(4) *Compare* with **hermit crab**, which appropriates a whelk-shell for its tender tail.
(*a*) The inner part being a spun silken tube.		(*a*) *Compare* with other **silk-producing** caterpillars.
(*b*) To the outside of which it sticks any of the available bits surrounding it.		(*b*) *Compare* with the **sticky cement** produced from the mouths of similar creatures, this particular cement being exceptionally good in hardening under water.
(*c*) And as only the head and legs project, this case being scarcely distinguishable from the surrounding objects, is **a perfect disguise.**	Telling.	(*c*) *Help class* to enumerate likely "bits" as—sodden **leaves** fastened firmly together; **rush stems** cut into short lengths; **grains of sand**, gravel, or tiny stones; **shells** of water-snails (even with living occupants); bits of **stick** (nearly always a wooden float above the head).

Insect Mimicry.

INSECT MIMICRY—*Continued*

Objects and Apparatus.—Caddis-Cases, or at least Pictures of them, and the Caddis-Fly in each Stage of Life ; Pictures or Specimens of as many Examples as possible of Protective Mimicry, and of Animal Defences generally.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(5) When the case is finished, the grub takes possession and **clings** tightly to it **with two little hooks** at the end of its tail.	Telling.	(5) *Tell* that the **grip** of the hooks is remarkably **strong**, and that the worm can **drag the case** after it very **easily** in its search for food. *Note* that when the case is **enlarged** the work is done **from the inside**, a little **added to the front** section, **widening** the capacity of the tube, while a section of equal length is cut off the rear, as the worm moves forward to new and wider quarters.
(6) Both entrances are stopped when the grub turns into the helpless **pupa** state, but it creeps to the surface before emerging as a perfect insect.		(6) *Relate briefly* the **concluding stages** in the life history. *Suggest* to children a **test** of the caddis larva's **building powers** under their own personal observation: That they should secure a caddis worm from a neighbouring stream—insert a knitting-needle in the case and give the grub a gentle poke till it moves forward a little, and then give a succession of pokes till it leaves the case—no amount of direct force will avail, as the worm will almost suffer to be pulled in two rather than relax its grip. Place the naked grub in a globe of clear water and induce it to form a new case under observation by supplying the small objects —say a few coloured beads.

CONCLUSION.—*In recapitulatory review bring out* the fact that **protective mimicry** is the **one resource of otherwise helpless** creatures—that insects commonly assume the exact **conformation**, precise **colour**, and shade of some commonplace **inanimate objects**, till even a keen-eyed **bird fails to discern** their presence ; for instance, the **lappet moth** can make itself look like the dead **leaf of a hawthorn**, using its legs to represent the leaf-stalk. *Draw attention* to protective mimicry in larger creatures, as thus—**trout** in shallow waters assume the general hue of the stream bottom, and **hares and rabbits** of the soil they run over ; **hedge birds** are sheltered by foliage in the summer, but when trees are bare in winter their dull grey coats do not betray them, against dark trunks, mossy boughs, or russet twigs ; even the dangerous showiness of the **pheasant** loses its conspicuousness in autumn against a background of ruddy autumnal leaves. *Lastly, offer food for reflection by suggesting* that **beasts of prey** occasionally follow the same rule in order to approach their victims unseen (**the opposite reason**)—as in the desert the lion, the snakes, and the insects are the same colour as the sand, or they might starve where food is so scarce.

XIII.—SPIDER

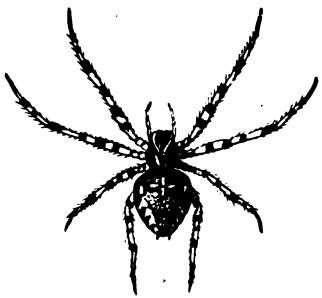
Objects and Apparatus.—Picture of Spider, with Enlarged Diagrams of Spinneret and other Features; a Live Specimen; a Cobweb; Pictures of Insects.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Spider, Real and Pictured.		
(1) A spider is a small creature, **like an insect.**	Observation.	(1) *Show* picture and *ask* for **name** of creature. *Ask* to what **kind** it belongs. If classed as an "insect," *ask* for a **suspension of judgment** till the spider has been examined.
(2) The spider is in **two parts**, head and chest being one part, and abdomen the other.		(2) *Show* side by side pictures of various **insects**, as fly, beetle, moth, bee—all "cut into" **three parts.**
(3) The spider has **eight legs** in four pairs.		(3) *Show* side by side pictures of various **insects**, as fly, beetle, moth, bee—all with **three pairs of legs.**
(4) The spider has a **leathery skin.**		(4) *Particularly note* its **covering**, which is **almost "crusty,"** approaching that of a shrimp or crab.
(5) The spider is **not an insect**, because—		(5) *Arrive at* this conclusion from observation and comparison.
(*a*) It is in **two regions instead of three.**		(*a*) *Note* that head and thorax are **united.** *Remind* that *insect* means "cut into"—**head, chest,** and **belly.**
(*b*) It has **eight legs instead of six.**		
(*c*) It **never has** any vestige of **a wing.**		(*c*) *Tell* that **wingless insects**, like the flea, do show some **vestige** of the wing, and can jump if not fly.
STAGE II.—Structure of the Spider.		
(1) The spider—	Telling, &c.	(1) (*a*) *Call to mind* the various **metamorphoses** or changes in insect life—egg, grub, pupa, perfect insect.
(*a*) Is born a spider, retaining the **same shape through life.**		(*b*) *Note* these other differences—an insect shows that it belongs to the "**jointed animals**"; a spider **disguises** the fact.
(*b*) Does **not show any ringed segments** in its close-fitting coat.		(*c*) **Insects** have **compound eyes** as well—a number of lenses clustered like the lobes of a blackberry.
(*c*) Has **simple eyes only**—one to six pairs.		(*d*) **Insects** breathe through tiny **air-tubes** all over the body.
(*d*) Breathes through **lungs.**		

SPIDER—*Continued*

Objects and Apparatus.—Picture of Spider, with Enlarged Diagrams of Spinneret and other Features; a Live Specimen; a Cobweb; Pictures of Insects.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) The **head**— (*a*) Is the front **part of the chest**; the hinder part bears the legs. (*b*) Has **two feelers** which are **hollow tubes** ending in **sharp claws.** (*c*) Through these tubes a **venom is darted** which is fatal to insect prey.	Telling, &c.	(2) (*a*) *Show* on picture—*guiding children's observation* of all the details in this Stage. (*b*) *Tell* that these "**feelers**" act like deadly **jaws.** (*c*) *Tell* that this poison is **harmless to us.**
(3) The **legs**— (*a*) Are of **great length,** each in seven joints. (*b*) **Feet are claws for treading delicately** on fine threads of web.		(3) (*a*) (*b*) *Lead class to see* (i.) that spiders depend on their agility and **nimbleness for securing prey**; (ii.) that they have **no wings**; and (iii.) therefore **rely upon their legs.**
(4) The **belly**— (*a*) Has on its underpart, near the end, four to eight perforated knobs called **spinnerets.** (*b*) There are **about 1000 holes** or pores, with **pipes running into a gland** or bag. (*c*) From this gland **a gummy fluid** runs out of the holes of the spinnerets. (*d*) This fluid **immediately dries into the threads** of which the web is made.		(4) (*a*) *Liken* to top of a pepper-box or **nose** of a **watering-can.** (*b*) Draw on B.B. an enlargement of a duct connecting gland and pore. (*c*) *Contrast* the silk spun by **caterpillars,** which comes out of the **mouth.** (*d*) *Call to mind* how **glue** can be **drawn** into threads which will **soon dry** quite hard.



A Large Spider.

STAGE III.—Characteristics and Habits.	
(1) The spider makes its **haunts in retired quarters.**	Questioning. (1) *Let children name* some favourite haunts—where it can be **undisturbed,** as in corners.
(2) It is sly and crafty, **setting traps** to catch its insect prey.	(2) *Question* to show the kind of snare—**a net** called a "cob-web."
(3) The spider **lies in wait** for its victim either in the middle of the web or in some dark corner.	Telling. (3) *Quote* a little of the poem "The Spider and the Fly."
(4) When a spider rushes out of its lair on to its prey, **it first uses its fore feet** to turn the victim round and **entangle it.**	(4) *Experiment* to show the web is **sticky** by touching with the finger—the **more** the victim **struggles** the more it is **entangled;** this is **necessary** to overcome **large insects.**
(5) When a victim is **made helpless,** it is bitten, and the pressure of the "jaws" on the poison-gland squeezes **a little venom** down the tube **into the wound.**	(5) *Note* that the **venom** of some spiders is powerful enough to kill small birds; that some large foreign spiders (**Tarantula**) are dreaded by man.
(6) The spider either **devours its prey** at once, **or stores it up** in its silky bonds for future meals.	(6) *Note* that the spider **cannot chew** its food, which has to be taken in **liquid form,** as by sucking the **blood and other juices** of its victim's body.

Spinnerets (enlarged).

STAGE IV.—Life History and Uses.	
(1) The spider is **produced from an egg.**	Telling. (1) *Explain* that a number of eggs are laid in a **silky** case or **cocoon,** which is **hidden** in some **nook.**
(2) The **baby spider** is fully formed a week after it is hatched.	(2) *Note* that there is **no grub or pupa stage,** as with insects.
(3) The spider **then casts its skin** whole.	(3) *Tell* that this is the first **moult**—there are **four or five** castings of the skin before the spider is **full-grown.**
(4) The spider **resembles the mother** in everything but size; it **leaves the nest,** dropping to the ground by a silken thread to commence life for itself.	(4) *Reckon* the **life** of a spider at about **four years.**

SPIDER—*Continued*

Objects and Apparatus.—Picture of Spider, with Enlarged Diagrams of Spinneret and other Features; a Live Specimen; a Cobweb; Pictures of Insects.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(5) **Uses in nature**— (*a*) As an insect-feeder, it **keeps insect life in check.** (*b*) **It forms the food of other creatures,** many birds being fond of spiders.		(5) *Show* how it thus assists in preserving "**the balance of nature,**" and that for its life work it is solely dependent upon its snare.
STAGE V.—Recapitulation and Additional Information.	Telling.	In recapitulation *show*— (*a*) Clearly the **differences** between spiders and insects. (*b*) They are the **link** between insects and crustaceans (crabs, &c.).
(1) Spiders are **clever spinners**—they belong to a class of the jointed animals called *Arachnida*, which means spinners.		(1) *Tell* the tale of **Arachne,** a maiden, according to Greek mythology, who was a weaver turned into a spider, and from whose name the class gets its title.
(2) Some spiders **use their threads**— (*a*) For snares. (*b*) For dwellings. (*c*) For bridges.		(2) *Instance*— (*a*) The **common spider** treated in the Lesson. (*b*) The **trap-door spider,** which lives in a little tunnel lined with silk, or the garden spider, which passes the winter in a silken dome near her snare. (*c*) The **young gossamer spiders,** which let a thread float loosely in the air till the free end catches and holds.
(3) Spiders are generally **regarded with aversion.**		(3) *Associate* **cobwebs** with dust and dirt; the spider's character is that of an **ensnarer.** *Quote* the fright of "**Little Miss Muffet**" of child-rhyme fame.

XIV.—COBWEB

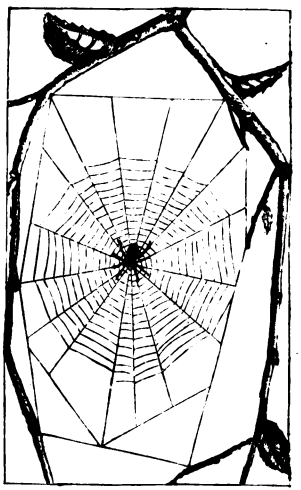
Objects and Apparatus.—A Web of Garden Spider; Enlarged Diagram of Same.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of a Cobweb.	Observation.	
(1) A cobweb is **a net** of very fine threads spun by a spider.		(1) *Examine* **specimen**; point out parts on enlarged **diagram.**
(2) It is **geometrical in pattern.**		(2) *Observe* **careful measurements**—evidenced by a series of short straight lines looking like a circle.
(*a*) Some threads form a boundary and **framework,** and are affixed to certain selected objects.		(*a*) *Note* **strength and firmness** of these.
(*b*) **Radiating lines** run from a centre to these boundary lines.		(*b*) *Test* carefully with finger—**not** very **elastic** and **not** at all **sticky.**
(*c*) A series of short lines follow a **spiral** course from the centre.		(*c*) *Test* carefully with finger—**very sticky** and **very elastic**—seem quite different to radiating lines.
(*d*) Sometimes **guy-lines** are added to steady the whole, when winds threaten it.		(*d*) *Recall* any observation of a bit of stick or similar **object** being **used to weight or balance** the structure—or guide-lines may appear on specimen.
(3) The lines are **elastic,** to yield rather than break in a wind.		(3) *Experiment* by pushing or **swaying** the lines.
(4) The central lines of the snare are **sticky.**		(4) *Feel* the **sticky spots**—at intersections of the **spiral** and radiating lines.
STAGE II.—How the Web is Built.	Telling.	
(1) When a spider wishes to spin a thread, it **squeezes a drop** of the sticky fluid out of the holes of the spinnerets **on to the spot** to which it is intended to fix the line.		(1) *By questioning recall* the structure and use of **spinnerets** of spider. *Illustrate* by **water issuing** from rose of a **watering-can,** except that all the jets diverge, whereas the spider threads **converge.** *Compare* the **viscous fluid** to treacle, or to **gum,** which so readily **adheres and dries.**
(2) The spider can either **keep the threads separate,** or can **unite the strands** into one thicker thread.		(2) *Illustrate* the **spinning operation,** by making a number of **fibres** converge, and twisting them **into one cord.**

COBWEB—*Continued*

Objects and Apparatus.—A Web of Garden Spider ; Enlarged Diagram of Same.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) The spider's **hind feet** are made like a pair of **combs,** which can be brought together **to twist the threads**, or employed to regulate amount used.	Telling.	(3) *Illustrate* by an enlarged drawing. *Remind* of use of **fore legs** for **entangling** victim—mark the use and **agility of all eight legs.**
(4) **Commencing with the boundary lines,** the spider sometimes spins a very **long thread,** and leaves it hanging from the body **for the wind to carry it** across the space, and lodge it upon some wall or twig, to which it will cling.		(4) *Note* that this is done to **bridge some space**—otherwise the procedure is as in (1). Sometimes a thread is **emitted from the body**, and sometimes **attached to available points,** the spider **descending and ascending**, and walking across from point to point. *Note* that these **foundation lines** are always laid **first,** and are very firm and strong.
(5) After the framework, the **radiating lines** are made, and lastly the **spiral threads,** all firmly **glued at intersections.**		(5) *Note* the **order of construction**—the **radiating lines** are **simple** threads, less elastic; the **spiral starts from the centre,** and completes the construction.
(6) Thousands of **sticky beads** of fluid dot the central snare, and are renewed almost daily.	Questioning.	(6) *State* that the whole operation can be **completed in an hour.** *Elicit* **advantages** of elasticity and stickiness in **securing prey.** *By questions elicit* that **spinnerets are underneath,** while the



The Spider's Web.

		eyes are on the top of the head, and therefore all this **elegant construction** is produced **by a delicate sense of touch** in its claws, and not by sight.
STAGE III.—Uses of Webs.		
(1) The common house spider, or the garden spider, spins to make a **snare.**	Telling.	(1) (*a*) *Hence derive* bad **character** which attaches to the spider, as an **ensnarer** and a **bloodthirsty** creature, whose **den** is dreaded by all insects.
(*a*) **He lives** in the centre or in some dark corner of the cobweb, **lying in wait.**		
(*b*) Being bold, active, and voracious, he **attacks insects bigger than himself**, pouncing on the victim immediately it is caught.		(*b*) *Instance* **unwary bees** as formidable prey to be dealt with.
(*c*) The prisoner is **seized and bound** with cords; being **turned round and round** with the fore feet as a **copious supply of the silk** cords are emitted.	Questioning.	(*c*) *Question out*—from previous Lesson—*recalling* use of the **merciless claws**, which are both **spears and poison fangs.**
(2) Spiders often **employ their silken threads**—		
(*a*) As **safeguards** against falling; or,		(2) (*a*) *Recall* the **ascending and descending** necessary to make framework.
(*b*) As **bridges** between elevated points.		,, the **floating** of loose ends, and the **drawing tight** after the end has caught.
		(*b*) *Illustrate* by poem of "**Bruce and the Spider.**"
(*c*) Some construct a kind of **balloon.**		(*c*) *Tell* that some **shoot out diverging lines** into the air, which, being **lighter than the atmosphere**, form a sort of **balloon**, "on which the little aeronaut mounts above."
(*d*) Some construct a **cocoon**, in shape like a wine-glass upside down, in which to deposit their eggs.		(*d*) *Name* **gorse** as a likely place to see **this beautiful object**, although it is soon afterwards daubed over with **mud to hide it from notice.**
(*e*) **Water-spiders** make an **egg-shaped cell** of silk; this they fill with air, and repose in it **beneath the water.**		(*e*) *Compare* this nest to a tiny **diving-bell**, in which the spider **reposes, head downwards**, after the manner of its tribe.

Objects and Apparatus.—A Web of Garden Spider; Enlarged Diagram of Same.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE IV.—Recapitulation and Additional Information.	Questioning.	*Bring out* in recapitulation :— (i.) The **elaborate nature** of webs—their architectural **design** and scientific **construction**—yet they can be **produced in absolute darkness.** (ii.) The **various uses** to which the **silky threads** are put—to make cocoons or **cradles** for the young, to make **nests** in the **air** or nests in **diving-bells**, to make **ladders, bridges, balloons**, to make **snares, hiding-places**, and what not. *Then may be added*—
(1) The **secretion** of the sticky liquid, from which the lines are made, is a **work of time.** (2) If a spider has been forced to make **several nets in rapid succession**, all its **silk is used up.** (3) **To wait** for a fresh supply would entail terrible **privation**; moreover, want of food would stop the secretion; therefore **war** is made on a **weaker spider, whose net is usurped.** (4) Spiders are naturally **chary of their silk**, as they never make webs when a storm is impending, and always mend and make in front of fine weather; **they are excellent barometers.**		*Lead up* through these four steps in **logical sequence.** *Then wind up by declaring* that however **out of place** spiders and their webs may be **inside a house**, there can be no doubt they are **beneficial in our gardens.**

XV.—CRAB

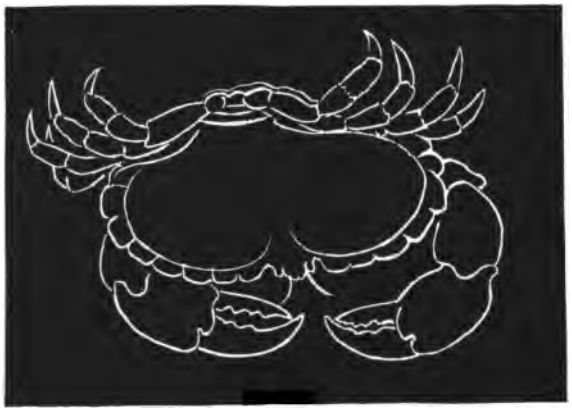
Objects and Apparatus.—A Crab ; a large Picture of Crab, Lobster, and Shrimp ; Picture of Crab-basket.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Specimen.		
(1) The crab is a creature with a **hard crusty covering, like a shell.**	Observation.	(1) *Note* that it is **not a mere shell,** like that of an oyster ; but **a covering shaped for limbs and parts,** as well as the body.
(*a*) This shelly plate on the **upper part** seems all **in one piece.**		(*a*) *Call* this **upper shield** in one piece the "**carapace.**"
(*b*) But on the **under side** the joinings of the **segments may be seen.**		(*b*) *Examine closely* for these **lines of juncture,** which mark the segments in all jointed animals.
(2) The crab has **ten legs** (or claws), five on each side.		(2) *Remind* that **insects** have six legs, **spiders** eight legs—now we come to ten-legged creatures : *count* legs.
(*a*) Although covered with shelly plates, these are **in parts jointed by a very tough skin.**		(*a*) *Break off* a "**claw,**" *disjoint* it, *and show* the strength, the pliability, and the "narrowing" of each **joint.**
(*b*) Next the head are the **two large claws,** or "jaw-feet," with very **strong toothed pincers.**		(*b*) *Note* **superior strength and size,** compared with other eight, which terminate only in pointed **claws, and not in pincers.**
(3) The crab has a **short jointed tail,** but it is tucked close **under the body.**		(3) *Contrast* with **long tails** of lobster and of shrimp—fan-shaped, and **trailed out behind.**
(4) It has **two eyes** set on **foot-stalks,** and also **two short feelers.**		(4) *Note* that the **eyes** are **black** and set on the tips of short thick stalks ; that the **feelers** are short and thinner. *Compare* with feelers and horns of **snail.**
(5) The **mouth** is on the under side, in the **middle of the chest.**		(5) *Note* **peculiar position** of mouth—where one would expect the **stomach** to be.
	Telling.	*Describe* **the comical sight of a crab feeding**—the food being tucked into the mouth, as if being pushed direct into the stomach by the huge claws.

Objects and Apparatus.—A Crab; a large Picture of Crab, Lobster, and Shrimp; Picture of Crab-basket.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE II.—Questioning on Foregoing Examination.		
(1) The crab is a "**crusty**" **animal** (*crustacean*) belonging to the class of **jointed animals.**	Questioning.	(1) **Name some** backboneless creatures belonging to the **jointed animals?**—(Worms, spiders, insects.) What can be **seen** on the covering of the crab **which shows that it also belongs** to the jointed animals?—(The **segments** of the tail, and the **ringed parts** of the claws.) How does the **crusty covering** of a crab **differ** from the **shell** of an oyster?—(There are **separate pieces** of the crab's shield to cover the different limbs and parts.) How do **both shells and hard shield rings** take the place of a **backbone?**—(Give **shape and firmness** to the animals.)
(2) The crab belongs to the **ten-footed** crusty animals (*decapods*), and to the **short-tailed** variety thereof.		(2) How **many legs** has a crab?—(Ten.) And what **kind of a tail,** as compared with a lobster?—(A short tail.) Because of these facts, **what might the crab be called?**—(A ten-footed, short-tailed, crusty animal.)
(3) The large claws or **jaw-feet** are conveniently placed near the head. (*a*) They serve as **weapons** to fight with. (*b*) They serve as **jaws** to seize and tear food. (*c*) One occasionally serves as **an anchor** for grasping rocks and sunken objects, when waves toss the crab about too much.		(3) With **what limbs** can the crab **seize prey? tear food?** or **hold to a rock** as with an anchor in rough weather?—(Big claws.) **What makes** the big claw a **dangerous weapon?**—(The powerful **pincers** with **toothed edges.**) Name the **various uses** to which the crab puts his **large claws?**—(They are used as jaws, as feet, as weapons, and as grasping limbs.)
(4) The common crab **cannot swim;** it can **only crawl.**		(4) What kind of **ends** have the eight **small claws?**—(Pointed.) **Why** do they seem **useless for swimming?**—(No flattened and widened part to serve as oars or paddles.) If the crab lives

	Telling.	**in the sea** and cannot swim, **how does it move** there?—(Crawls along the bottom.) *Tell* that there are **swimming crabs,** whose **hinder feet are flattened** like oar-blades.
STAGE III.—Structure and Habits. (1) The common **edible crab lives** commonly just **below low-water mark.**	Telling.	(1) *Explain* high- and low-water marks by recalling experience at the **seaside**; *or briefly tell* the bare facts of **periodical tides,** and of wave-washed **lines of refuse.**



A Crab.

A Crab Pot.

(2) All crabs **feed on animal substances**; they are useful in **purifying the water** by removing dead animal matter.		(2) *Designate* these useful creatures "**sea scavengers.**" *Describe* how a **dead fish is devoured,** the bigger crabs tearing the flesh in large pieces, the lesser ones getting the smaller fragments, till the whole is speedily eaten up.

CRAB—*Continued*

Objects and Apparatus.—A Crab; a large Picture of Crab, Lobster, and Shrimp; Picture of Crab-basket.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) Crabs are **quarrelsome**, and they are **fond of living prey.**		(3) *Describe* how they **eat up small sea-animals**, as well as dead carcases—how they **fight and eat each other**; tell that if a dozen crabs were imprisoned in the same vessel, only one would be left in the course of a few days, that one the strongest of the **cannibal** crew.
(4) **Structure**—		(4) (*a*) *Tell* that crabs **live out of water** several days—till the **gills become dry.**
(*a*) The crab breathes by **gills.**		(*b*) *Tell* that there are **horny teeth within the stomach** itself; so that to masticate their food, crabs first **tear it into fragments** by the jaw-feet, secondly **nip it into smaller morsels** by the jaws themselves, and finally **grind it almost to powder** by these stomach teeth.
(*b*) The **stomach** lies closely against the head, while the **heart** is far beneath it.		
(*c*) The **eyes** are set on foot-stalks to see all round.		(*c*) *Compare* to a lighthouse or **beacon,** seeing and seen all round.
(5) Crabs—	Comparison and Questioning.	(5) (*a*) *Compare* with the **moults and skin-sheddings** of other animals. *Elicit* that if **shell will not grow**, it must be **shed** each year **till crab arrives at full-grown size.**
(*a*) **Cast** off their **unyielding armour every year**, even to the covering of the eyes and the lining of the stomach.		
(*b*) Have the **power of** casting and **reproducing an injured limb**	Telling.	(*b*) *Recall* the **fighting propensity**; *suggest* an **escape with** an injured limb, and the necessity of replacing it; the stump is torn off almost painlessly, close to the body, and a **new limb begins to grow** in place of the old one. *Explain* that a crab **sometimes seen with one jaw-foot smaller** than the other, is in process of growing one which will in course attain full size equal to the other.
STAGE IV.—Recapitulation and Additional Information.	Questioning.	*By questioning elicit* that crabs belong to (*a*) the **backboneless,** (*b*) **ringed animals,** (*c*) of the division with **jointed legs,** (*d*) of

		the class with **crusted coverings**, (*e*) of the order with **ten legs**, and (*f*) of the tribe with **short tails**.
(1) The characteristics of a crustacean are—	Telling.	Then may be added—
		(1) *Name* crabs, lobsters, prawns, and shrimps as **crustaceans**, or "crusty coats."
(*a*) A **crusty shell in place of internal bones,** giving firmness to limbs and trunk.		(*a*) *Compare* with **internal skeleton** of higher animals or **vertebrates**.
(*b*) A **body built** up of a number of **rings or segments.**		(*b*) *State* that there are **twenty-one segments** in all, if they could be seen, but are often **too closely joined** to be visible.
(*c*) The body in **two chief portions**: one formed of **head and chest**, the other of **abdomen.**		(*c*) *Explain* that "**chest**" here means that which **in higher animals** is called the chest.
(*d*) The **limbs more than six** in number.		(*d*) *Distinguish* from **insects and spiders** in respect of number of **legs.**
(*e*) The breathing by **gills.**		(*e*) *Note* that all the crustaceans are **water-breathers.**

XVI.—LOBSTER

Objects and Apparatus.—A Lobster ; a Shrimp ; a Crayfish ; a Prawn ; or Pictures of same.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Specimen.		
(1) The lobster is a "**crusty coated**" **animal**, with an **outside skeleton.**	Observation.	(1) *Compare* with **crab** and shrimp. *Contrast* with **internal skeleton** of any vertebrate.
(2) The **body** is encased in rings or **segments**, those of the **hinder part being jointed**, those of the **fore part not.**		(2) *Name* the head shield the "**carapace.**" *Note and count* the **distinct segments** of the jointed **hinder part.**
(3) Its **colour** is bluish-black ; when boiled for human food it turns red.		(3) *Exhibit*, if possible, a **boiled** and an **unboiled** specimen side by side ; or, *tell* this fact.

Objects and Apparatus.—A Lobster ; a Shri np ; a Crayfish ; a Prawn ; or Pictures of same.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) The eggs are cast off and **hatched into strange-looking creatures**, which grow by a succession of moults till they resemble the parent lobster.		(2) *Tell* that these tiny creatures are **not baby lobsters,** but only begin to **resemble their parents after several moults.**
(3) The **young lobsters** then **moult once a year,** growing larger till they are full grown.		(3) *Detail process :*—**Shell** will **not stretch,** yet **animal** continues to **grow** ; once in each year the animal **ceases from feeding, and hides away** from foes in some crevice ; flesh becomes **thin and watery,** and muscles contract till **shell becomes quite loose,** and finally **splits open** ; by a great effort the animal **draws its limbs out** of their shell covering, **creeps out** of its old garment, its **skin** now being **soft and yielding** ; immediately its **skin begins to grow,** increases beyond the size of the cast garment, and **by degrees hardens,** till in about two weeks the shell is as hard and firm as the old one ; it then **resumes active life** for another year ; and so year by year till **maturity** ; the most **marvellous thing** being the withdrawal of the muscles of **the great claws** through **apertures** at the joints **smaller than themselves.**
STAGE IV.—Recapitulation and Additional Information.	Questioning.	*By recapitulatory review bring out* salient points—such as the **similarity** between these **water-breathing crustaceans** in life-history and habit, their wonderful healing powers, and their reproduction of lost limbs. Crabs and lobsters are both **caught in baited traps** of basket-work, into which it is easy to crawl, but difficult to find the way out again.
(1) **Other** crustaceans—		Then may be added—
(*a*) **Crayfish,** smaller than lobster, lives in our streams and rivers, generally in tunnels it makes in	Telling.	(*a*) *Distinguish* lobster as a **sea-animal.** Lobster **less wholesome** to eat than crayfish, but **in season all the year round,** whereas crayfish is fit to eat for brief seasons only.

the mud, and guards as fiercely as the land crab guards its home.

(*b*) **Shrimps** feed on putrid matter floating on edge of the tide; they are left in pools by retreating tide, but are difficult to see, being same colour as the sand.

(*c*) **Prawn**, like a large shrimp, but has a prickly back—a very cleanly creature.

(*b*) *Compare* with lobster—same method of **feeding**; similar **formation**, having tiny **pincers** in place of jaw-feet; **shrimpers** catch them in **fine nets** on the end of long handles.

(*c*) *Distinguish* from **shrimp** by large size, harder and **brighter covering**.

Tell that they have a **front pair of legs** fitted with fringe-like **brushes**, and with these they diligently **wash and brush** every part of their bodies.

A Lobster.

XVII.—OYSTER

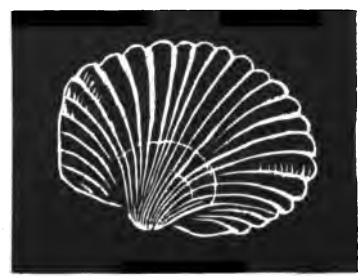
Objects and Apparatus.—An Oyster; several pairs of Empty Oyster-shells; Mussel-shells; Cockle-shells; Mother-of-pearl Trinkets.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Oyster.		
(1) An oyster is a **soft-bodied** creature protected by a **shell in two separate pieces.**	Observation.	(1) *Note* **size**, about four inches broad; **shape**, broader than long; **hinge**-side narrow; soft oval **body** inside. *Smell* sea-water **freshness.**
(2) The two shells, or "**valves**," **differ** slightly. (*a*) The **upper** or right-hand valve is the smaller, and is **flattish.** (*b*) The **lower** or left-hand valve is the larger, and is **convex.**		(2) *Pass round* several pairs of **empty oyster-shells** *for observation* of these points, to which teacher *draws attention, and helps children to describe.*
(3) **Outside** they are **brown** in colour, "foliate," or made up of **thin plates**, and thinner near the edge.		(3) *Children observe, as teacher draws attention* to these points in due order.
(4) **Inside** the shells are smooth and pearly white; a dark **scar** is seen near the centre.		(4) *Feel* **smoothness** and hardness. *Admire* **brilliancy** of surface. *Experiment to discover* what the semicircular **scar** is—as below.
(5) (*a*) The oyster is soft, but has **a strong muscle** in the centre of the body **to keep the shell closed.**		(5) (*a*) *Open* the oyster carefully so as to allow the children to see the **strong adductor muscle** broken away from the "scar" before the shells can be opened; *cut off* the broken piece, *pass it round* to show its toughness, and also *exhibit* the scar from which it was cut.
(*b*) Two flat dark **flaps surround the whole body**; they are called the "beard," but are really the **gills.**	Telling.	(*b*) *Examination* will reveal the gills, as a delicate **frill of striped bands.** *Tell* that they are the gills, or **breathing organs.**
(*c*) The **gills** enclose the mouth, and are covered with a number of very **minute hairs** (*cilia*) which the		(*c*) *Proceed to tell* these points in the animal's **structure**, although it may be impossible for the class to discern them in the specimen. An enlarged chart will be most useful.

living animal keeps **in constant motion** to cause a current of water to flow over the gills— (i.) To supply the necessary air for **respiration.** (ii.) And with the water a constant supply of **food.**	Telling and Inferences.	*Experiment*—**set up a current** in a tub of water by the waving action of a fringe of some material. (i.) *Tell* that water contains air, and if the oyster is to live it **must have air to breathe.** (ii.) *Tell* that oyster cannot eat **solid food, nor** yet move about in **search of food;** that the same waving **motion** over the gills parts the lips, and **carries to the mouth** microscopical creatures, and particles of decaying matter, which form the food of the animal.
STAGE II.—Questioning on the Foregoing Examination. (1) The oyster is a **bivalve,** or soft-bodied creature, protected by two shells. (2) **Outside,** the shells are **rough and strong** for hard usage on the sea-bottom. (3) **Inside,** the shells are **lined** with beautiful smooth **pearl.** (4) The **gills,** nearly surrounding the whole body, enclose between them the mouth, which is shown by white lips; their remarkable **action brings water into the shell** for the creature's respiration, and its feeding as well.	Questioning.	(1) *By questions obtain* that the oyster is a soft-bodied animal (*mollusc*), **protected by** a shell in two parts, or "**two valves**" (*bivalve*), —as distinct from *univalves*, such as snail and whelk—**one being convex to contain the body.** (2) *Infer* the **dangers** of rough usage from the **strength** of the foliated **plates**; the **close fitting** of the **edges** from the **thinness** thereof; the **foes to be kept out** by the **strength** of the hinge **ligament,** and of the adductor **muscle** (the former springing the valves open, and the latter closing them at the will of the oyster). (3) *Infer* the delicate **softness** of a body which **needs** such a beautifully smoth **bed** to lie upon. *Discover* that each valve is **lined with a semi-transparent coat.** (4) *Work out by questioning* that the oyster being an animal **needs to breathe and to feed**—that it possesses **no organs of locomotion** and cannot move about in search of food—that it **lives in the depths** of the **sea** and is a **water-breather**—that its gills are **more than breathing organs,** they are really a **substitute for limbs** of locomotion, and obtain **food** as well as **air** to breathe. *Detail, by question and answer,* the facts:—Neither lips **nor gills can protrude** beyond edges of the shell—the living oyster **partly opens the valves**—innumerable little fringe threads or "**cilia**" **affixed to the gills set** up a **waving motion** which causes a **current** of water to **run** steadily between the valves, and from which the creature **takes air to breathe and food to eat.**

OYSTER—*Continued*

Objects and Apparatus.—An Oyster; several pairs of Empty Oyster-shells; Mussel-shells; Cockle-shells; Mother-of-pearl Trinkets.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE III.—Structure. (1) The **mouth** is near the hinge; the dark-coloured parts at the back of the mouth are the **stomach** and the **liver**; then the **muscle** for closing the valves at will; the **intestine**; the **egg-bag**; the **gills**; and lastly the **mantle**. (2) The **mantle** is a thin transparent coat, the delicate **fringe edges of which** are a number of glands which **secrete the substance of the shell and the paint** with which some parts of it are coloured. (3) The **growth** of the shell is effected by the mantle. (4) If the surface of the mantle is **irritated,** it has a tendency to **secrete larger quantities** of the substance (mother-of-pearl.	Telling.	(1) *Briefly point out* on diagram, proceeding in order from the narrow hinge end, outwards. *Exhibit* oyster at same time. (2) *Show* **appropriateness of the name** "mantle"—it lines each valve of the shell, and encloses the whole body of the oyster. *Hold* shell (or pearl trinket) up to light, to display **iridescence**. (3) *Exhibit* a shell sawn through—*note* that it has been **increased in two directions**, thickness and general size. (4) *Teach* that **precious pearls** are merely **globular** formations round a grain of sand which has got into the shell, and irritated the soft body of the oyster. The real **pearl oyster** is found at Ceylon—all oysters, mussels, and similar creatures **spread their pearl as a lining** to their shells, and as such it is called **mother-of-pearl** (nacre).  A Cockle-shell.

STAGE IV.—Recapitulation and Additional Information.

(1) It is not easy to find a spot **suitable for oyster beds,** for—
(*a*) **Sand** gets between the valves and prevents them from being closed.
(*b*) **Mud** chokes up the gills.

Questioning.

Telling.

Review by recapitulatory questioning.
Then may be added—
(1) *Tell* that **"native"** oysters are cultivated at **mouth of Thames.**
Other places round our coasts cultivate less expensive oysters.
(*a*) and (*b*) *Question out,* **cause to effect.**
Name **warmth** as another requisite, a **chill** being fatal to the "spat."

Mussel-shells (Shut and Open).

Oyster and Open Shell.

(2) **Eggs** of an oyster may number from one to two millions.
(*a*) They are **hatched inside** the shell, and called **"spat."**

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(2) *Intimate* that oysters must have **many dangers** to outlive, or their **increase** would be **enormous.**
(*a*) *Describe* **"spat"** as having the **appearance** of slate-pencil powder.

OYSTER—*Continued*

Objects and Apparatus.—An Oyster; several pairs of Empty Oyster-shells; Mussel-shells; Cockle-shells; Mother-of-pearl Trinkets.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*b*) At first they are **carried in the gills** of the parent, but about May are **cast out** to shift for themselves. (*c*) **Oyster farmers** place faggots, broken crocks, hurdles, empty shells, &c., at the bottom for the spat to fasten to, and upon which to grow to maturity.		(*b*) *Describe* formation of a delicate **transparent shell**, with fine threads (*cilia*) hanging out, by means of which **the spat swims** about, rising and sinking like gnats under a tree, till a **suitable object** is found to which **to affix themselves.** (*c*) *Show* **great care needed**, and hence infer **high price** of good oysters. *Name* ten or twelve years as **period** necessary **to mature**, if the oysters safely escape such **foes** as— (i.) The **starfish**, which opens the shells by main force and devours the oyster; (ii.) The **sea-worms**, and (iii.) The **whelk**, which both bore right into the shell.

XVIII.—SEA ANEMONE

Objects and Apparatus.—Sea Anemones, or Pictures of same; a Boy's Sucker.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Sea Anemone. (1) A sea anemone is a "**flower-animal**" which is found in the **sea.** (2) They **affix themselves to rocks,** and look like plants growing there.	Observation.	(1) *Exhibit* specimen, or wall picture. (2) *Note* the **appearance** of being "**rooted.**"

(3) They have **fleshy**, jelly-like **bodies.**		(3) *Feel* specimen ; *or*, in their absence, *describe* **jelly-like substance** of body.
(4) Around an orifice or **opening** they have a number of **fingers** or tentacles, which **wave freely** to and fro **in the water,** and with their brilliant **colours** glistening in the light, they look **like flowers** as **beautiful** as any which grow on the land.		(4) *Name* this opening the **mouth** of the creature, and the **tentacles** the hands or organs of **grasping.** *Feel* (*or describe*) the **tiny keen-edged darts** with which the tentacles are sometimes armed for grasping and holding. *Compare* **tentacles** to the **petals** round corolla of a real flower. *Infer* that, possessing **brilliant colours,** these "plant-animals" will not be found in the darksome depths of the sea, but **in shallower waters,** where their brilliant **colouring may be displayed** in the sunlight.
(5) Beyond the tentacles and a mouth opening into the stomach, **anemones have no other parts** (visible).		(5) *Challenge* any one to **find a head,** or eyes, or other organs. *Help class to describe roughly* as a **fleshy bag,** with a small **opening for a mouth,** encircled by **rays** to serve as hands.
STAGE II.—Anemones in Repose and in Action. (1) When in **repose** tentacles are **folded** in, till the animal appears **like a rounded lump of fleshy substance** fastened to the rock.	Telling, or Experimenting with Living Specimens.	(1) *Note* that they **shrink** in size—reduced to appearance of a piece of **raw beef**; or some show **softly tinted round bodies,** a wrinkled **depression** on upper surface being **only indication of an opening** in the mass.
(2) **Without organs of sense,** nerves, and blood-vessels, the **anemone** is yet **sensitive.**		(2) *Tell* that the slightest **touch,** the **shadow** of the hand, or even a **passing cloud** will **cause** tentacles **to shrink,** and the animal **to shut itself up ;** yet in **clear water,** under the **influence of the sun's rays,** the animal becomes **full of life** and energy, and **expands its tentacles** like the petals of a beautiful flower.
(3) It can exist **without food for a considerable time, but** when opportunity offers is very **voracious.**		(3) *Sum up*—it **can feed,** and it **can feel,** though not very much ; yet it possesses no bones, no shell ; no head, no legs ; no eyes, ears, or nose ; no heart, no lungs.
(4) **At times** it is gently **waving,** as though the **sensitive rays**— (*a*) Bending gracefully from and towards the centre were **setting up feeble currents** which would tend to carry floating particles into its mouth.		(4) *Compare* with action of **cilia** in the gills of an **oyster.**

Objects and Apparatus.—Sea Anemones, or Pictures of same; a Boy's Sucker.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*b*) Or, as if **feeling for something good to eat,** which if they touch they **cling to, and carry to the mouth.**		(*b*) *Experiment* by putting a **finger** to the living specimen—it will **close upon it, and cling to it** so firmly that it will suffer to be torn rather than loosen its hold.
STAGE III.—How Sea Anemones Feed, Travel, Repair, and Reproduce.		
(1) Sea anemones **capture and eat passing morsels** of fish, or **prey upon small sea animals.**	Questioning.	(1) *Infer* from previous stages, a **flesh food,** and a **capture** of it **in passing.** *Infer* the **fierce struggle** that would ensue with a **small crab** which came within the reach of the tentacles—that the anemone would **lose several rays in the fray** rather than relinquish its prey, and that **victory** would generally **remain with the captor.**
(2) When a **shrimp** or some small fish comes within reach— (*a*) The **rays** secure it. (*b*) The **mouth** opens. (*c*) The **victim disappears.**	Telling.	(2) *Refer* to the **attracting current** set up. (*a*) *Tell* that some kinds possess **stings,** thousands of fine threads which **pierce the victim** and kill it. (*c*) *Tell* that if it could not take in the whole, it would **digest the part drawn in.**
(*d*) In a day or two afterwards, the mouth opens, and the **lifeless body is thrown out** again, **sucked dry** of all its blood.		(*d*) *Tell* that the anemone cares **only for the juices** of the body; and that the **digested food** appears to **pass through the walls of the stomach** into the body, and **circulate** into the tentacles.
(3) The anemone has **a flat base** like a boy's sucker— (*a*) It can **glide along the rock** when it requires a more favourable situation.		(3) *Experiment* by attaching a **boy's sucker** to a slate. (*a*) *Compare* with **movements** of belly-footed creatures like **slugs and snails.**

(*b*) And **sometimes** it loosens and **floats away** to a more suitable spot.

An Anemone

(4) Anemones possess such **wonderful powers of repairing injuries**, that **fragments** in a week or two **grow into perfect animals.**

(*b*) *Mention* that they are **sometimes** known to **invert** themselves and **walk on their tentacles.**

Anemones.

(4) *Suppose* the **hold** on the rock is **so firm** that a piece is **wrenched off**—not only does the **main portion** settle down and repair its loss, but the **fragment** left behind grows into a perfect anemone **—assumes a rounded form** in a few days, then **an opening appears**, and out comes a **circlet of rays**—a complete animal in a short time.

SEA ANEMONE—*continued*

Objects and Apparatus.—Sea Anemones, or Pictures of same; a Boy's Sucker.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(5) The **usual** way they **increase** and reproduce is **by eggs**— (*a*) **Clusters form** on partitions near the walls of the stomach; (*b*) Fall into the cavity below, and then are **shot out of the mouth.**		(5) *Note* the foregoing (4) as **one way,** and this as **another way,** of increasing in numbers. (*b*) *Estimate* the **size** at the time of discharge into the sea, at about that **of a pin's head.**
STAGE IV.—Recapitulation and Additional Information.	Questioning.	*By recapitulatory questioning review* the preceding, *dwelling on*— (*a*) The fact that anemones are **animals** which feed, and **not plants** rooted to the soil. (*b*) Their wonderful **powers of repairing injuries** whereby they can **increase their numbers.** (*c*) The **beautiful forms** assumed by the different varieties of these **sea-flowers.**
(1) Sea anemones may be **found in the rock pools** around our coasts. (2) Here their beautiful **forms, colours, and movements** may be **watched**; or they may be **carried home to keep** in sea aquaria.	Telling.	Then may be added— (1) *Specify* likely **places** being between the tide marks, and **time** at lowest tide. (2) *Recommend* **removal** from the rock with a blunt knife, or the **chipping of the rock** itself; **carry** away in wet weed; **feed** with flies, worms, and bits of beef; *caution* that they will **absorb enormous quantities of water** in obtaining their supply of food and oxygen.

XIX.—SCALE OF ANIMAL LIFE

Objects and Apparatus.—Pictures of Animals, numerous and various; some of the Higher, and some of the Lower Forms.

INTRODUCTION—

Ask for **names of animals** children have seen, or know from information.

Teacher will then name **many others** of the countless multitude the children are never likely to see—*pointing out* pictures where present.

Declare the **importance of knowing** as much as possible about animals, both for **pleasure** and for **profit**—as about pets and useful animals at least.

Impress the **necessity of arranging such knowledge** in order—as scholars are arranged into boys, girls, and infants, and afterwards into classes—or as a librarian classifies his books in such a way as to know a single volume amidst many thousands of others.

Say that the animal creation is often called the **animal kingdom**; and that as in a kingdom of men there are **different ranks and orders**, some higher, some lower (as dukes, earls, barons, and commoners), so in the animal kingdom there are higher and lower orders.

Elicit from previous knowledge, or from wall-pictures displayed, which are **higher animals** and which are **lower**, and **why** they are so—that **man is highest** of all animals because of that brain power which gives him the mastery over all the others, however big or strong they may be.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—The Higher Animals. (1) **Man** stands highest in the animal kingdom—a backboned creature, **a pattern to start with.**	Questioning on previous knowledge, supplemented by Telling.	(1) *Pass* from the **brain-pan**, or skull, to the **column of bones** on which it rests. *Feel* the **ridge** of these bones down the back—*give* the backbone as a **standard to start with**—then the **differences** in the animal kingdom will be those of the very **framework** of the body, **affecting the intelligence** and instinct, limiting and marking the **powers and capabilities**, according to **structure**—not differences of rank in mere name. (*Employ simple language.*)
(2) **Sub-Kingdom, or Division I.**—"**Backboned animals**," or *Vertebrates*, have **a skull and an internal skeleton** held together by a vertebral column or backbone.		(2) *Note* that man alone has a **perfectly erect** backbone—then come apes attempting the erect position—but monkeys lead at once to the animals with **horizontal backbones**, as dogs, horses, lions.

SEA ANEMONE—*Continued*

Objects and Apparatus.—Sea Anemones, or Pictures of same; a Boy's Sucker.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(5) The **usual** way they **increase** and reproduce is **by eggs**— (*a*) **Clusters form** on partitions near the walls of the stomach; (*b*) Fall into the cavity below, and then are **shot out of the mouth.**		(5) *Note* the foregoing (4) as **one way,** and this as **another way,** of increasing in numbers. (*b*) *Estimate* the **size** at the time of discharge into the sea, at about that **of a pin's head.**
STAGE IV.—Recapitulation and Additional Information.	Questioning.	*By recapitulatory questioning review* the preceding, *dwelling on*— (*a*) The fact that anemones are **animals** which feed, and **not plants** rooted to the soil. (*b*) Their wonderful **powers of repairing injuries** whereby they can **increase their numbers.** (*c*) The **beautiful forms** assumed by the different varieties of these **sea-flowers.**
(1) Sea anemones may be **found in the rock pools** around our coasts. (2) Here their beautiful **forms, colours, and movements** may be **watched**; or they may be **carried home to keep** in sea aquaria.	Telling.	Then may be added— (1) *Specify* likely **places** being between the tide marks, and **time** at lowest tide. (2) *Recommend* **removal** from the rock with a blunt knife, or the **chipping of the rock** itself; **carry** away in wet weed; **feed** with flies, worms, and bits of beef; *caution* that they will **absorb enormous quantities of water** in obtaining their supply of food and oxygen.

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Teacher will then name **many others** of the countless multitude the children are never likely to see—*pointing out* pictures where present.

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MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—The Higher Animals. (1) **Man** stands highest in the animal kingdom—a backboned creature, **a pattern to start with.**	Questioning on previous knowledge, supplemented by Telling.	(1) *Pass* from the **brain-pan**, or skull, to the **column of bones** on which it rests. *Feel* the **ridge** of these bones down the back—*give* the backbone as a **standard to start with**—then the **differences** in the animal kingdom will be those of the very **framework** of the body, **affecting the intelligence** and instinct, limiting and marking the **powers and capabilities**, according to **structure**—not differences of rank in mere name. (*Employ simple language.*)
(2) **Sub-Kingdom, or Division I.—"Backboned animals,"** or *Vertebrates*, have **a skull and an internal skeleton** held together by a vertebral column or backbone.		(2) *Note* that man alone has a **perfectly erect** backbone—then come apes attempting the erect position—but **monkeys lead at once to the animals with horizontal backbones**, as dogs, horses, lions.

SCALE OF ANIMAL LIFE—*Continued*

Objects and Apparatus.—Pictures of Animals, numerous and various; some of the Higher, and some of the Lower Forms.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
CLASS 1.—"**Sucklers**," or *Mammals*, are **warm-blooded**, produce their **young** in a **living** state, and are more or less **covered with hair.**		1. *Examples*— "Two-handed" (*Bimana*), man. "Four-handed" (*Quadrumana*), monkeys. "Flesh-eaters" (*Carnaria*), bat, mole, bear, lion, whale. "Gnawers" (*Rodentia*), rat, hare. "Cud-chewers" (*Ruminantia*), ox, sheep, stag. "Thick-skinned" (*Pachydermata*), elephant, horse, pig. "Toothless" (*Edentata*), sloth. "Pouched" (*Marsupialia*), kangaroo. — Differentiate coverings of fur, hair, and bristle.
CLASS 2.—**Birds** (*Aves*) are **warm-blooded**, are hatched from **eggs**, and covered with **feathers.**		2. *Instance*— "Birds of Prey" (*Raptores*), as eagle, owl. "Perchers" (*Insessores*), including song birds—as sparrow, swallow. "Climbers" (*Scansores*), as parrot. "Scratchers" (*Rasores*), as fowl, pigeon. "Runners" (*Cursores*), as ostrich. "Waders" (*Grallatores*), as stork. "Swimmers" (*Natatores*), as swan, goose, duck. — Classified according to beak or foot.
CLASS 3.—**Reptiles** (*Reptilia*), or creeping creatures, are **cold-blooded**, produced from **eggs**, breathe by **lungs**, and are sometimes **covered by scales or plates.**		3. *Instance*— "Snakes" (*Ophidia*), as grass snake. "Scale-covered" (*Sauria*), as crocodile. "Shielded" (*Chelonia*), as tortoise.
CLASS 4.—**Double-lived creatures** (*Amphibia*) live both on land and in water; are **cold-blooded**; and		4. *Instance*—Frog and toad (*Batrachia*). *Note* that they possess **feet, not fins.**

breathe by **gills** when young, and by **lungs** when mature.

CLASS 5.—**Fishes** (*Pisces*) are **cold-blooded**, and breathe by **gills**.

5. *Divide* into two orders, first those with **skeletons of bones** (as stickleback), and those with skeleton of **gristle** (as sturgeon).

STAGE II.—The Lower Animals.

(1) **Sub-Kingdom, or Division II.**—"**Animals without a backbone**," or *Invertebrates*, have a **nervous system**, which is distributed in knots all over the body; they hardly ever have red blood.

Telling, or Questioning in a cursory review of previous Lessons.

(1) *Note* that here we have **left** the animals with an **internal skeleton**—we now come to the countless myriads of **boneless creatures**, generally **small**, which inhabit the **air**, crawl over or burrow beneath the **earth**, and with which **waters** often swarm.

(2) The "**soft-bodied animals**" (*Molluscs*) possess **a large "nerve-mass"** (or *ganglion*), and so rank next to the vertebrates; as—

(*a*) Cuttle-fish, with shell inside.
(*b*) Snail, with shell in one piece.
(*c*) Oyster, with two shells.

} Body not jointed; and often with hard shell.

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(2) *Explain* that it is a safe plan to **arrange** these lower creatures **according to the nervous system**, for in the higher animals the **brain is the centre** of the nervous system; for this reason the **oyster**, which has no limb, which cannot move an inch, **ranks above crabs** and lobsters, and even above the insects, for the oyster in its **nervous system** is much **superior to the bee**, with all its wonderful skill and activity.

(3) The "**jointed-leg creatures**" (*Arthropoda*), with body and legs jointed, and a **hard skin**; as—

(*a*) Insects—three pairs of legs, body divided into three regions, often winged.

(*b*) Spiders—four pairs of legs, body divided into two regions, never winged.

(*c*) Centipedes—many pairs of legs, a separate head, but no other distinct regions; never winged.

(*d*) Crustaceans—number of legs, and arrangement of regions various.

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(3) *Tell* that—

(*a*) Insects are **classified according to their wings**, as "sheath-winged" beetles, "straight-winged" grasshoppers, "scale-winged" butterflies, "two-winged" house-fly, "invisible-winged" flea, &c.

(*b*) *Differentiate* **regions**, insects having head, chest, and abdomen—spiders have head and thorax in one.

(*d*) *Note* that these (crabs, shrimps, &c.) are **water-breathers**, while the first three are **air-breathers**.

SCALE OF ANIMAL LIFE—*Continued*

Objects and Apparatus.—Pictures of Animals, numerous and various; some of the Higher, and some of the Lower Forms.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(4) **Worms** and leeches (*Annelidæ*) have ringed bodies, without limbs, or with very simple limbs that are not jointed.	Telling, or Questioning in a cursory review of previous Lessons.	(4) *Note* that in some classification worms are put among the other "jointed" or articulated animals, as their **bodies are ringed if their limbs are not.**
(5) (*a*) Then come "**rayed animals,**" or animals of the star pattern, like the star-fish.		(5) (*a*) *Note* that the "star-fish" is **not** properly **a fish** at all. *Include* sea-urchin among the rayed animals.
(*b*) And, lastly, among the **lowest forms of life** we have—		(*b*) (*Ignore* **microscopical creatures** altogether.)
Flower-animals (*Anthozoa*), as sea anemones and corals.		*Give* the alternate scientific name (if necessary), **zoophyte.**
Hydra-animals (*Hydrozoa*), as jelly-fish.		*Note* that all these are of **simple structure**, and have **few organs.**
First-animals (*Protozoa*), as sponges.		*Note* that "first" here implies the **first step beyond plant life.**

CONCLUSION AND TEST—

Reassure scholars by saying that the most learned **naturalist** does not know a quarter of the animals to be met with in his own country; but he **knows** what animal any strange one **most resembles**, and with time and patience he puts it into its right class; so with **children**, they may not know the names of strange animals, but they may try to find out **what sort** of creatures they are, and put them in their right classes.

Conclude with a **test exercise**—namely, the arrangement of the wall-pictures under their various classes (as far as they are represented), starting with the higher forms of life, and coming down step by step to the lowest, and giving a reason for the locating of each one. [Many of the examples instanced in this Lesson have been dealt with more fully in the preceding Lessons.]

XX.—A PLANT

Objects and Apparatus.—Plants (weeds) sufficient for each child to have Several Specimens ; a Piece of Charcoal ; a Vessel of very Cold Water ; a Sprouting Onion.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of a Plant.		
(1) A plant is **a living thing**, for it **grows**, and in the end it **dies**.	Observation.	(1) *Distribute* some plants (**weeds**) whole, as pulled from the soil. *Note* that some are already drooping and **beginning to die**. *Infer* that they **must have life.**
(2) As a plant grows, **it increases its height**, and the number and size of **its parts.** (Some plants produce flowers and bear fruits.)		(2) *Show* specimens of same plant in **various stages of growth.** *Show* specimens **in flower**, and some **gone to seed.**
(3) **Some of the parts** perform the work of **feeding** the plant, viz.—		(3) *Infer* that **if it grows**, or increases its size, **it must feed.**
(*a*) The **root** (always present).		(*a*) *Suffice it here* that children know roots "**suck up**" **nourishment**—that the root is the **descending part.**
(*b*) The **stem** (nearly always present).		(*b*) *Note* that the stem is the **ascending part**—that it **bears the leaves** (appearing at **intervals**, some **singly**, some in **pairs**, some in **clusters**, and some in **whorls**) and the **flowers in due season.**
(*c*) The **leaves**— (i.) Having flat expanded portions called the **blades** ; (ii.) Set upon **leaf-stalks.**	Telling.	(*c*) *Note* **variety** in the **shapes** of leaves. *Tell* that the leaves assimilate or **digest the plant-food** ; both that **absorbed by the roots**, and the larger portion they **take in themselves from the air.**
(4) **Other parts** are concerned in the **reproduction** of the plant, viz.—		(4) *Allude* to the **seasons**—the "budding" spring—the leafy summer —the "fall" of the year.
(*a*) The **flower**, and (*b*) The **fruit or seed** which succeeds it.	Appearing on some plants at certain seasons of the year.	(*a*) *Remind* that **there are flowerless plants**—no one ever saw flowers on ferns, mushrooms, or sea-weeds. (*b*) *Gather* that **seeds** follow the **blossoms** ; that seeds are "set" **to grow similar plants**, and so continue the species.

Objects and Apparatus.—Plants (weeds) sufficient for each child to have Several Specimens ; a Piece of Charcoal ; a Vessel of very Cold Water ; a Sprouting Onion.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE II.—Individual Examination of Specimens. (1) **Roots**—not green—always descend into soil—growing away from the light—are fine tubes—sometimes a cluster of thready roots, sometimes a thick fleshy root. (2) **Stem**—green or woody—round, or angular, or flat—erect, or climbing, or running along ground—when present it is to lift up plant into the air, for it grows towards the light. (3) **Leaves**—green—on stalks—grow out from stem singly, in pairs, in clusters, or in whorls—of various shapes, and smooth or rough—edges plain or notched or saw-like. (4) **Flowers** (where present) of various colours and shape—sometimes perfumed—give way in time to the succeeding fruit or seed for reproduction.	Observation and Questioning thereon.	*Conduct the examination of specimens through selected scholars.* *By questioning assist* each scholar *to examine and describe* his own specimens ; namely— **To point out** and name the **parts**. **To describe** their appearance and characteristics. **To tell** their **uses**, as far as knowledge goes. *Lead* class to tell that during **a certain part of the year** we find that most plants have only a root, stem, and leaves ; that **later** they produce **flowers** ; that these in time produce **fruits and seeds**.
STAGE III.—How a Plant Grows. (1) Plants feed and grow ; to do so they **must have water.**	Questioning.	(1) *Work out by questions* that a thing cannot die unless it is **first alive**, therefore **a plant** is **a living thing** ; to live it **must**

have nourishment; that if the **stem** or all the **roots** are **cut through**, the plant **soon dies**; therefore it **derives some of its nourishment** through its **roots**—that it may be noticed how **plants rooted in perfectly dry earth** begin to **wither**, but **revive** if the earth is **watered.**

(2) **Roots** descend into the soil, and **spread out in their search for nourishment.**

(2) What **part** of the plant is **always present?**—(Root.) Why is it often **difficult to uproot** a plant?—(Spreading roots.) **Why** do **roots branch** out in growing downwards?—(Searching for food.)

(3) Roots **drink up the water of the soil**, and this water **contains** small quantities of nearly **everything which a plant requires.**

(3) *Ask* what **water** does to **salt.**—(Dissolves it.) What the **soil consists of.**—(Particles of earthy matter, such as chalk, iron, lime, sand; and vegetable matter, such as decaying leaves.) Show that these **solids are dissolved** by rain water, and in **solution are absorbed** by the living plant, which could not "suck up" solid matter.

(4) Although **most plants require moist earth** about their roots, **some can do without** earth if they have plenty of water.

(4) *Help class to recall* instances in which they have noticed **plants growing with little or no earth**, as hyacinth **bulb** growing in a glass jar full of water; **cress** growing on a moist flannel; **duckweed** growing on surface of a pond; **ferns** growing in the crevice of a wall.

Exhibit a **sprouting onion** bulb, and ask—What is this onion **beginning to do?**—(To grow.) What must the onion have obtained **to make it grow?**—(Water.) But it has not been near any earth, either moist or dry, but has been hanging up in a net, so **where** must it have **obtained the moisture** to start its growth?—(From the **air.**)

Experiment. *Experiment* to prove there is moisture or **invisible vapour in the warm room** by bringing a cold glass of water for **condensation** to take place on outside of glass.

(5) The **stem carries upwards** what the roots collect, and the **leaves digest** this food for the use of the plant.

Questioning. (5) *Discover* that we know a plant is alive **by its green leaves**; that leaves are **connected** to the **roots** by the stem; that they digest or **prepare what the root sends them** for the use of the plant; that they **obtain a much larger portion of the nourishment themselves** from the air.

Compare stem to **throat**, and leaves to **stomach.**

Objects and Apparatus.—Plants (weeds) sufficient for each child to have Several Specimens ; a Piece of Charcoal ; a Vessel of very Cold Water; a Sprouting Onion.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(6) Plants **also require carbon,** which they get from the **air.**	Telling.	(6) *Tell briefly* that so long as a plant lives it goes on **adding to its store of carbon;** that whereas a **sapling** would contain scarcely enough **carbon** to fill a **thimble,** a full-grown **tree** would contain enough to fill a **cart.** *Exhibit* **charcoal** and call it carbon. *Describe* constituents of plants, very simply, to be mainly a **watery** juice which can easily be squeezed out of the **green living substance**) ; and **carbon** * (which makes up the **skeleton** or harder parts of the plant) ; as thus, if heat be applied to a plant, the **watery part** can be driven off as **vapour** or steam, and the **bulk of the remainder** will burn black, or "char" into **charcoal.**

CONCLUSION.—In recapitulatory review *use simple phraseology to bring out the main facts*, viz.—(1) That a plant is **a living organism,** with organs members, or parts to act as tools or instruments in the performance of certain specific **functions** (nourishment and reproduction). (2) That plants **mainly feed on water and carbon** (or, rather, carbonic acid), and can readily be resolved into hese wo constituents. (If the *experiment* be performed of charring a well dried plant on a shovel held over a hot fire, care must be taken that it does not become too hot and burn away to a white ash. *Mention* that charcoal burners pile billets of wood in a pyramid, but to prevent it burning away cover the pile with earth and turf.)

* Carbon really exists in plants only in combination with oxygen, hydrogen, and nitrogen, as cellulose, starch, and albuminoids, which on heating to redness in a closed vessel, split up into wood spirit, tarry matter, and charcoal.

XXI.—SEEDS

Objects and Apparatus.—Fruits, Nuts, Berries, Pods, Grains, and Seeds ; Germinating Broad and Scarlet Beans, Wheat, and Indian Corns ; sufficient for distribution round the class.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Introduction and Examination of Sprouting Seeds.		
(1) The **seeds** of a plant when **fully ripe are stored** up for a following season ; if then set in the ground they **produce new plants** similar to the parent plant.	Introduction.	(1) *Gather* that the **autumn** is the "harvest-time" of ripened seeds—that some seeds are then stored away—to be sown in the **following spring** or "seed time." *Hand round for examination* such **seeds** as peas, acorns, kernels from stone fruit, apple pips, grains of corn, and the very small seeds of common garden flowers—all carefully *labelled.* *State* that for readier examination the teacher has **selected large seeds,** namely, beans ; a **few** of which have been **prepared by soaking** in water till growth (germination) has commenced.
(2) The seed is covered with a tough **outer skin** (*testa*).	Observation supplemented by Telling.	(2) *Compared* with a **dry bean,** the skin of the **soaked seed** will appear loose and wrinkled : it is a **protection.**
(3) The **inner kernel** easily splits into **two thick solid lobes,** called seed-leaves.		(3) *Remove the skin, and split open* the inner parts carefully with a knife or point of a pen. *Lay* the two halves side by side *for observation. Call* them **"seed-leaves."**
(4) They were **joined** together by a sort of **hinge** (*hilum*) near which is the **germ of the new plant.**		(4) *Point* to the edge which was marked by a long black **scar.** *Tell* that this marks the spot where the seed was attached to the seed-bag (ovary). *Observe that the lobes were* **joined** together here. *Tell* that the little hinge is the **most important part** of the seed—for it holds the beginning (or germ) of the new plant.
(5) The **germ** contains **two parts,** namely— (*a*) The young **stem** (*plumule*) pointing upwards. (*b*) The young **rootlet** (*radicle*) pointing downwards.		(5) *Employ* beans in **various stages of growth** to show— (*a*) The **plumule** is really a tiny bud, which will make its way upwards **towards the light** to form the stem and the leaves. (*b*) The **radicle**—its name meaning a "little root"—will make its way downwards **from the light,** and become the root searching in the soil for nourishment.

Objects and Apparatus.—Fruits, Nuts, Berries, Pods, Grains, and Seeds ; Germinating Broad and Scarlet Beans, Wheat, and Indian Corns ; sufficient for distribution round the class.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(6) The seed-leaves are called **cotyledons**, and they contain **a store of** food of the proper kind for the baby plant to live upon till it can feed itself.		(6) *Note* that the seed-leaves remain **in the protecting skin** until the rootlets force their way into the soil. *Show* a sprouting plant on which the seed-leaves have **changed colour and shrivelled up**—*discover the reason*, namely, that they **have done their work**, which was to supply the young parts with food until they could provide for themselves by rooting in soil. *Compare* with **egg**, which contains the germ or beginning of a tiny chicken, which begins to germinate or grow as soon as the **hen applies the warmth** of her body by sitting on it, and which is **nourished by the yolk** till it is fully formed to run about and find its own food. *Liken eggs to* **kernels of seeds** which are **miniature plants**, living, but **sleeping**—waiting to be **awakened into active life** by warmth and moisture. *Gather* that seeds contain a **germ** which consists of **three parts**—the radicle, plumule, and **cotyledons**. *Tell* the last-mentioned technical name, *syllable* it, and *write* it on Blackboard.
STAGE II.—The Two Great Classes of Seeds. (1) Some seeds contain **two seed-leaves**, and some have **one.**	Observation.	(1) *Exhibit* some **grains** of corns which have been kept **warm and moist**—*explain* this preparation to account for their **various stages of growth.** *Cut open* a softened grain of Indian corn from top to bottom, so as to divide into **two broad, flat halves** ; *examine* the sections to discover :— (*a*) The **seed** itself, in the centre of the grain, with plumule and radicle, as before ;

(2) Seeds which have two seed-leaves are called **dicotyledons.**
Seeds which have one seed-leaf are called **monocotyledons.**

(3) (*a*) **Dicotyledonous** plants include the **vast majority of plants** in all parts of the globe.
(*b*) **Monocotyledonous** plants seem to belong more to the **hot regions** of the earth ; but in this country we have the **grasses** of all kinds, lilies, hyacinths, and onions.

(4) All that **seeds require** to make them germinate or grow, are **warmth, moisture, air.**

Telling.

(*b*) Only **one seed-leaf** (and this not a thick and solid lobe) enveloping the germ ; and
(*c*) A **store of food distinct** from the young plant, but to nourish it, as before.
Arrive at this great fact—**some seeds** contain **two** seed-leaves, and **some only one.**

(2) *Give names : explain* that **di** means "two," and **cotyledon** means "seed-leaf." *Explain* that **mono** means "one," and **cotyledon** means "seed-leaf."
Syllable and write these terms on the Blackboard to be learnt.
Mention that there are a few plants which possess more than two seed-lobes.

(3) (*a*) *Instance* nearly all the common **herbs** and **shrubs, fruit trees, and forest trees.**

(*b*) *Instance* **palms,** bamboos, and **canes.** *Note* that they are not unlike **gigantic grasses**—include all the cereals (wheat, rye, barley, &c.), or **corn grasses.**
Lead class to note the great **distinction between the leaves** of one kind, and those of the other.
The one bears **net-veined** leaves. } *Illustrate* with blades
The other bears **parallel-veined** leaves. } of grass, and leaves of trees.

(4) *Express admiration* for the **wonders of a seed,** containing as it does **all the necessary parts** of a plant (root, stem, and leaves), **waiting** only for the **essentials to germination** to waken it into active life.
Note that the amount of **warmth** required differs with different plants.
Note that as soon as the **moisture** is absorbed, the seed begins to swell, and needs more room—and then the skin which has protected it so far from injury bursts, and the little plant seems to ask for **air.**

STAGE III.—Recapitulation and Additional Information.

By *review questioning* bring out *main points* of Lesson, viz.—
(*a*) That seeds **subjected to influence** of moisture, and a certain temperature, begin to sprout, or **germinate.**
(*b*) That **cotyledons** serve the purpose of **feeding the baby plant,** till it can find its own food.

SEEDS—*Continued*

Objects and Apparatus.—Fruits, Nuts, Berries, Pods, Grains, and Seeds; Germinating Broad and Scarlet Beans, Wheat, and Indian Corns; sufficient for distribution round the Class.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		(*c*) That the root is the **descending axis** of the plant, and the stem the **ascending axis.** (*d*) That as plants have **no power of locomotion** their food must be placed near them, and that **gaseous and fluid matters of earth and atmosphere** are converted into **solid herbage** by them. Then it may be added—
(1) Sometimes cotyledons { Rise **above the soil,** and assume a green colour. / Remain **below ground.**		(1) *Instance* lupin and common turnip—for which they supply the purpose of temporary leaves. *Instance* common pea and bean—where the lobes shrivel and finally disappear as their nourishment is absorbed.
(2) In flowerless (or **acotyledonous**) plants, in place of seeds little germs are formed, called **spores.**		(2) *Argue* that if there are **no seeds,** there can be **no seed-leaves** or cotyledons—therefore, that non-flowering plants may be called by a name meaning "**without cotyledons**"—they are acotyledonous plants. *Instance* the brown **spores** found on the back of fern "leaves" or **fronds.**
(3) Thus **all the plants in the world** may be divided into three classes, according to the **nature of their germs**— Dicotyledons. Monocotyledons. Acotyledons.		(3) *Name* examples of each.
(4) Although **seeds** are intended first of all for the reproduction of the plant, many seeds are **used by man for his own purposes.**		(4) *Conclude with a test exercise*—to **name useful seeds and specify the uses** to which man puts them; as grains and pulse for **food**; malt, cocoa, and coffee for **beverages**; mustard and linseed for **oil**; nutmeg for **spice**; pepper for **condiment**; poppy for **medicine.**

XXII.—HOW SEEDS SCATTER

Objects and Apparatus.—Any of the Seeds undermentioned, according to Season and Convenience.

INTRODUCTION—

By rapid questioning elicit—The evils of **overcrowding**—the gradual lessening of **living space and breathing room,** the shortening and consequent dearness of **food supplies**—all of which evils are **overcome by emigration** and the colonisation of new lands. *Apply same line of argument* to plants if **seedlings grow too closely around the parent plant**—the **overshadowing** and the struggle for a share of **air, light, and nourishment**—resulting in the tender plantlets being weakened—in the **deterioration of species.**

Ask how **man** prevents his **useful plants,** such as wheat and cabbages, from growing weaker and getting worse through the lack of space and new soil?—(He scatters seed in **prepared ground.**) *After describing* planting and **broadcast sowing,** *state* the Lesson will be to discover **how** weeds, forest trees, and other **wild plants** scatter their own seeds wide apart in "**self-setting.**"

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—By the Wind (Flying Seeds).		
(1) Some seeds as they fall from **tall trees,** are **whirled** away on the wind by	Telling.	(1) *Pre-suppose* a ripening and a drying of the seeds, followed by a **shaking and a dispersing in a high wind.**
(*a*) A **single wing,** or an attached thin flat blade, or by		(*a*) *Instance* the ash and the pine seeds.
(*b*) **Two wings,** or double blades.		(*b*) *Instance* the maple, and other seeds popularly called "**bunches of keys.**"
	Experiment. Observation.	*Let fall* from a height some of the aforementioned **seeds,** if possible **in a breeze** from open window; then *observe* how winged seeds **lose much time by fluttering** and turning round as they fall to the ground, giving the wind **more time to blow them farther away,** towards more favourable spots for germination, for growth into strong healthy plants. *Then let fall* some two-winged seeds of the same kind, but with the **wings clipped from a few**; *observe* **difference** in the fall.

HOW SEEDS SCATTER—*Continued*

Objects and Apparatus.—Any of the Seeds undermentioned, according to Season and Convenience.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) Some **low-growing** plants have **plumed seeds**, which are covered by such **light down**, that they become actual "flying seeds."	Telling. Experiment. Observation.	(2) *Instance* ripe **dandelion** heads and **thistle-down.** *Puff* at a dandelion "**clock**"; and *observe* how easily and lightly the downy particles **float away** on the air; *perform same experiment* with a ripe **thistle-head**, turning down if necessary the enclosing bracts. *Teach* that **natural ripening** dries and bursts this cover, **letting in the air** to dry and spread the hairs, till **every puff of wind** distributes some. *Note* that each **speck** is a seed, floating on these **downy wings.** *Allude to*, and if possible *exhibit*, a seed-pod of the **cotton plant**, so **prolific** in the production of these **downy floating hairs**, as to have set up one of the most important **manufacturing industries** in the world. *Purposely make a mis-catch* at one of the dandelion seeds, so that the **movement of the hand** through the air **wafts it higher still**—to show how easily such are carried upwards as well as onwards, and that there is **no question of falling downwards**—the plants **grow too low** for gravitation to serve their purpose—but they **advantage** by the **slightest breeze.**
	Questioning.	*By questions elicit* that the active **natural forces** aiding in these dispersions have been (*a*) **Wind**, and (*b*) **Gravitation.**
STAGE II.—By Rolling, by Floating, or by being Shot Away (Sportive Seeds).		
(1) Some seeds simply **fall and roll** a short distance away.	Telling.	(1) *Instance* **nuts** which (*a*) are **round**, and (*b*) **protected** by a hard shell.
(2) Some are **shot** a distance by the **springiness** of their **bursting pods.**	Observation.	(2) *Instance* the pea, gorse, and broom. *Examine* some **pods**, as ripe and dry as possible; *show* how the

Pea.

(3) Seeds, like the cocoa-nut, will **float across** the waves of the **sea without injury**, and spring up and flourish in some distant land.

Telling.

pod dries, cracks, and finally **opens into two valves**; that the **seeds are heavy**, and would fall to the ground at once if some **special contrivance** were not arranged to **scatter them**; that this contrivance consists of **strong fibres going across** each valve in a **slanting** direction, which, when they **dry, shorten and pull** the shell into a spiral or corkscrew shape, **twisting out the seeds** and throwing them **one by one** to a distance.

Liken to a rough boy who tears off his **waistcoat** violently, making the **buttons fly off** one by one.

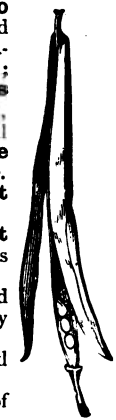
Remind of a walk across some **common on a hot day**, when the sun is drying the gorse and broom pods so fiercely that they **crackle and pop** all around.

Experiment.

Experiment to compare the **lateral distances** dispersed first by **dropping nuts** from a height, and then by **flirting peas** from something springy.

(3) *Instance* the **cocoa-nut palms** and other plants found on coral islands.

Suggest a **sportiveness** in these three methods of distribution—as if seeds played at **bowls**, at **shooting**, and at **swimming**.



Fruit of Wall-flower.

STAGE III.—By Depending on Animals.

(1) Some seeds are **hooked**, and scatter themselves by **clinging to passers by.**

Observation.

(1) *Instance* goose-grass, burdock, forget-me-not. *Distribute* these or others *according to season.*

Recall any experience of passing through thick **undergrowths** in summer-time and finding such **seeds clinging to clothing**, particularly to rough woollen stockings.

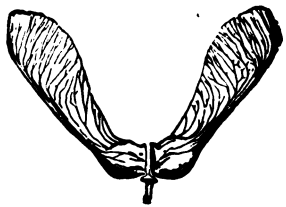
Observe (i.) the **ease** with which the fruit **leaves the stem**; and (ii.) the **force** with which the **bristly hooks cling**—say, to wool of **sheep**, hair of **cattle**, feathers of **birds**—who get rid of the ripe balls by **brushing against hedges** or trees a distance from where they picked them up.

(2) Some seeds **tempt birds and animals** to carry them away—

(2) *Remark* that in some cases the **carrying away may be involuntary**, as of **hooked** or **sticky** seeds.

HOW SEEDS SCATTER—*Continued*

Objects and Apparatus.—Any of the Seeds undermentioned, according to Season and Convenience.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*a*) Because they are **eatable.**  Winged Fruit of the Maple. (*b*) Because they **appear to be eatable.**	Telling.	(*a*) *Instance* sweet juicy **pulp-fruits,** such as are eaten by thrushes and finches, who **eat the soft part and drop the seeds**; or the **hips** and haws of the **hedges**; or, in **warm countries,** the lemon, orange, melon, eaten by such creatures as **parrots** and monkeys. *Note* that in the latter case the seeds are hard enough to **pass through the body** without being digested; in the former the seeds of **stone fruit** are cased in hard **protective shells.** *Quote* the case of the **missel-thrush,** so fond of the berries of the **mistletoe**—the seeds of which are **so sticky they cling** to claw and beak, and are **rubbed off** on the **bark of apple** or other rough tree, on which they **take root and grow.** (*b*) *State* that some seeds are evidently **mistaken for very small animals**—such as spiders, caterpillars, or beetles—carried a short distance, and then **dropped in disgust**; or some **look tempting** and are **dropped** when found to be **hairy or ill-tasted.**
STAGE IV.—Recapitulation and Additional Information.	Questioning.	The chief points to *review* are— (*a*) The **necessity for distribution** by a wide dispersion, incidentally mentioning— (i.) The **vast number** of seeds **produced.** (ii.) The **large proportion of seedlings that perish,** not merely for want of space, but through being **eaten by birds, snails,** and other creatures. (*b*) Some of the **strange methods of distribution** dealt with.

(1) The **results of seed distribution** may be seen in— (*a*) A **new railway embankment**, which quickly covers itself with **green growth**. (*b*) The **rich vegetation** found on **coral islands**. Small piece of Coral, magnified, showing the extended Tentacles of the Coral Polyps.	Telling and Questioning.	*Then may be added—* (1) *Lead* from cause to **effect**. (*a*) *Question* on this **clothing of new-made ground**—as by seeds already in **surface-soil**, plumed **seeds** wafted, and **seeds dropped** by birds; the growth of "**annual**" weeds, which **spring up** in numbers and **scatter more seeds** for the next season; then the slow "**perennial**" plants which last several seasons (such as **grasses to form turf**), and though they **come up last**, manage to **establish themselves** firmly. (*b*) *Tell* that there are islands **built up by little creatures** (polyps) in the sea, which **cannot exist out of the sea**, and therefore **perish as soon** as their coral rock **reaches the surface**; yet many of these islands are covered with vegetation, the **seeds** of the plants having been **carried over-sea by birds or by floating** on the waves from neighbouring lands.

XXIII.—ROOTS

Objects and Apparatus.—Distribute Tap-roots (as Turnips, Radishes, Beets, Parsnips, Carrots) sufficient for every two or three scholars to have at least one specimen among them; distribute Fibrous Roots (as Grass, Daisy, Butter-cup) sufficient for every scholar to have a specimen each; also Rootstocks as far as available.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Two Kinds of Roots. (1) Some roots are large and **fleshy**, and are called **tap-roots**: (*a*) They are **rounded** or globose. (*b*) **Conical**, or tapering at bottom end, or—	Observation.	(1) *Tell* the name "**tap-roots**," and *examine* these first. (*a*) *Instance* turnips. (*b*) *Instance* parsnip or carrot, with broad flat part just **below** the stem.

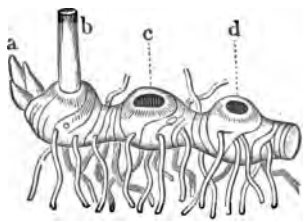
ROOTS—*Continued*

Objects and Apparatus.—Distribute Tap-roots (as Turnips, Radishes, Beets, Parsnips, Carrots) sufficient for every two or three scholars to have at least one specimen among them; distribute Fibrous Roots (as Grass, Daisy, Butter-cup) sufficient for every scholar to have a specimen each; also Rootstocks as far as available.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(*c*) **Spindle-shaped,** tapering at both ends; And **all have small fibres** growing out of them. (2) A second kind of root is **fibrous.**	Telling all names.	(*c*) *Instance* radish. *Note* that they are **coloured,** as well as pulpy; and that the **root-hairs**—the real mouths of the plant—are near lowest end of root. (2) *Instance* daisy roots. *Discover* that instead of being coloured like the carrot or the beetroot, these roots are of a **whitish** appearance; grow in a **cluster,** like a bunch of threads or fibres. *Experiment to show* that the latter are also **strong and tough,** whereas the carrot or radish is **brittle.** If the fibres throw off branches, *call* these smaller ones "**fibrils,**" and the root a "**branching fibrous root.**" *Show* a "**root-cap**" or protected point where the root penetrates the soil.
STAGE II.—The Three Uses of the Root to the Plant. (1) The Roots are the **mouths** of the plant, drawing **nourishment from the soil.** A plant has as many mouths as it has **root-hairs.**	Telling.	(1) *Explain* that the extremities or tips of root-fibre are the **growing points,** consisting of bags or cells, which **imbibe fluid matters** and convey them upwards to the stem. *Note* that **all material** required for the growth of a plant is **found in the soil and in the air**—the **roots** being put into relation with the former, and the **leaves** with the latter. *Explain* that roots **penetrate the soil** even through cracks in rocks, choosing convenient crevices; that the **free ends** are soft and spongy, and **absorb moisture** rapidly, seeking it wherever it lies; that of the quantity absorbed, the **greater part**

		is sent out again by the leaves, owing to the fact that the **solid mineral matters** which form so important a part of the plant's food, are **dissolved in such minute quantities** in it. *Explain* that **root-hairs** are very delicate little things growing out of root-fibres.
(2) **Tap-roots** serve as a **storehouse** of nourishment for future use.	Questioning.	(2) *Recall by questioning* that carrots, parsnips, and all **root crops are gathered** in the **first season** they are grown from seeds—that during this **first year** they bear **no flowers**—that though the leaves wither, an ungathered plant is **not dead**—but in the following spring will send up **new leaves** and an upright stem—in the summer the **flowers will appear,** followed by the **seeds** which will form and ripen. *Deduce* that the **food** for the new leaves, &c., is **stored up** in the root during the first year—that the **tap-root having done its work dies**—hence they are always **pulled up in their first year** by cultivators.
 Hair-like Root of a Grass. Conical Root of the Carrot.	Telling.	*Explain here* that **flowering plants** are divided into three great classes :— **Annuals,** which live only for one year. All annuals have fibrous roots, needing no storehouse. **Biennials,** those which do not flower until the second year, and in the majority of cases die after the seed has ripened —store up food in tap-roots to live through the first winter. **Perennials,** those which live and flower year after year for a number of years ; these usually die down to the ground as winter sets in, but some portion is kept alive till the following spring (as in the tuberous root of the dahlia, for instance). Trees and shrubs all have branching **woody roots.**
(3) A third use of roots is to support the plant.	Questioning.	(3) *Ask* why trees are so **seldom blown down** ; *gather* that **as branches spread** out, so do the **roots to anchor** them. *Liken* each **fibril** to a hand **laying hold** of the earth.
STAGE III.—Strange Forms of Rooting. (1) Some plants have **rootstocks** (*rhizomes*) or **underground stems,** to which **new roots grow** as the plant spreads.	Observation.	(1) *Instance* mint, raspberry, bracken. *Compare* with runner of strawberry, which grows **along the surface.**

Objects and Apparatus.—Distribute Tap-roots (as Turnips, Radishes, Beets, Parsnips, Carrots) sufficient for every two or three scholars to have at least one specimen among them; distribute Fibrous Roots (as Grass, Daisy, Butter-cup) sufficient for every scholar to have a specimen each; also Rootstocks as far as available.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
 Rhizome of Solomon's Seal: *a*, terminal bud from which will be developed next year's stem; *b*, this year's stem; *c*, *d*, scars of the stems of previous years.		*Note* that the **runner** of the mint is **not a root** but a stem; **roots do not possess buds.** *Distribute* rootstocks, all specimens having the underground stems present. *Examine* the **nodes** or knots on runners, sending **new stems** and leaves **upwards** and **new roots** from the **under side**; *gather* that runners are the **means** by which the parent plant **provides food for the young plant** till its roots can obtain food from the soil—that **thus do some plants** "stray," "creep," and **spread, and never die so long** as there is **a piece of living rhizome** or tuber **left in the ground**. *Account* thus for rapidity with which coltsfoot, bindweed, and twitch-grass spread, and the **difficulty of eradicating** these farmers' pests.
(2) In **some** plants the roots, in place of descending directly into the soil, **appear first in the air**, and then reach the earth.		(2) *Exhibit* picture of **banyan** or other trees of fig tribe; or of mangrove tree. *Mention* that there are in warm countries some **orchids** whose roots embrace other plants, but never touch the ground.
(3) **Some** plants **send their roots into** the stems or roots of **other plants**, and derive nourishment from them.		(3) *Instance* the **mistletoe**, the dodder, and the broom-rape; or other true **parasites.**
STAGE IV.—Recapitulation and Additional Information.		In the recapitulatory review *bring out*— (*a*) The close **connection** between the **kind of root** and the **duration of life** in a plant. (*b*) The **storage of food** in tap-roots and in runners, both **dying when work is done.**

(1) The uses of roots to man are many and various— (*a*) As **food** and in **beverages**. (*b*) As **medicine**. (*c*) In **manufactures**.	(*c*) The **variety in runners**—underground, partly underground, and above surface. *Then may be added—* (*a*) *Instance* carrot, radish, tapioca; and in beverages chicory and ginger. (*b*) *Instance* arrowroot, turkey rhubarb, liquorice; the rhizome of blue and white flags are dried into orris root. (*c*) *Instance* beetroot (sugar).

XXIV.—STEMS

Objects and Apparatus.—A variety of Herbaceous Stems, and Twigs of Trees; Specimens of Wood; Bamboo, Cane, Flax, Hemp, Bark, Bast; any or all of Specimens mentioned in Notes.

INTRODUCTION—

Gather that stems, in the vast majority of plants, are erect for the purpose of **lifting the leaves and flowers above the ground** so as to place them in the most **favourable position** for receiving the **influence of light and air**, upon which their due actions so much depend; that—

(*a*) Sometimes the stem **creeps** along the **surface** of the ground, as in the iris.
(*b*) Sometimes the stem remains entirely **underground**, as in the asparagus.
(*c*) The **eyes of the potato** are but **leaf-buds**, and hence it is a kind of underground **stem.**
(*d*) The **bulbs of lilies** are but **underground buds**, developed on underground **stems**, the roots proceeding from the lower part.
(*e*) What are called the root or **corms** of tulips and crocuses are only **subterranean thickened stems**, producing buds above and roots below.

} The characteristic of the stem being the provision made by it for the **production of leaf-buds.**

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Stems (Pictures and Specimens). (1) Stems **vary in shape**; thus some are— (*a*) **Round.** (*b*) **Angular.** (*c*) **Flat** (with thin edges).	Observation.	(1) (*a*) *Instance* stems of young trees. (*b*) ,, ,, mint, sage, wallflower. (*c*) ,, ,, sweet-pea and vetch. } *Cut* in transverse section examples of each.

STEMS—*Continued*

Objects and Apparatus.—A variety of Herbaceous Stems, and Twigs of Trees; Specimens of Wood; Bamboo, Cane, Flax, Hemp, Bark, Bast; any or all of Specimens mentioned in Notes.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) Stems **differ in nature** and substance— (*a*) Some being **herbaceous.** (*b*) Others being **woody.** Sections of Angular Stems.	Telling.	(2) (*a*) *Explain* herbaceous to mean "**herb-like**"; *examine* some stems of "**green herbs**" (say a marigold or mignonette) *to discover* that such are (i.) **green**; (ii.) **soft**; (iii.) **juicy**; (iv.) with **no tough fibres.** (*b*) *Examine* stems of young trees *to discover* that such are (i.) **hard**; (ii.) **drier** than the herbaceous stems; (iii.) **dark** in colour, not green; (iv.) **tougher** in fibre. *Teach or gather* that **both** woody and herbaceous stems may be found **on same plant**; but **such green stems** contain some woody fibre, and unless they die down in winter will **become woody next season.**
(3) Besides the erect position assumed by so many plants, there are various other **modes of growth**; as— (*a*) The **prostrate** or trailing. (*b*) The **creeping.**	Observation.	(3) *Instance* most of the common flowers and weeds which **grow up straight.** (*a*) *Instance* the garden nasturtium. (*b*) *Instance* strawberry **runners** (literally "stray"-berry); and the **offsets** of the house-leek.
(*c*) **Twining** (coiling themselves round some object for support).	Supplemented by remarks in passing.	(*c*) *Instance* scarlet-runners, honeysuckle, hop, convolvulus. *Remark* on the curious fact that plants of the same kind **always coil in one direction,** while plants of another kind may always coil in the opposite; thus the convolvulus and the hop always coil opposite to each other.
(*d*) **Climbing**— (i.) Lifting themselves by **tendrils.** (ii.) Lifting themselves by tiny **rootlets.**		(*d*) (i.) *Instance* the pea, the vine, the Virginia creeper. *Remark* on the last-named, which forms at **the end of each tendril a disc** that acts like a boy's sucker. (ii.) *Instance* the ivy—**these rootlets differ** from those in the soil—being numerous they give a large **total**

		of strength for clinging and spreading over a surface.
(iii.) Lifting themselves by hooks or **thorns**.		(iii.) *Instance* wild-rose, bramble, and brier.
(*e*) **Underground stems**.		(*e*) *Instance* mint, Solomon's seal, potato. *Note* that the **potato is a tuber** whose solid flesh is **starchy food** intended to feed the **young plant** of the following season.
(*f*) **Bulbs** (really buds, covered with scales).		(*f*) *Instance* the lily and the onion, sometimes erroneously regarded as roots.
(*g*) **Corms** (more solid than bulbs).		[stems. (*g*) *Instance* crocus, snowdrop—really flattened underground
(4) The stems of some plants are **protected by hairs, or by thorns**.		(4) *Instance* **hairy herbaceous plants**, thistles and **thorns** (hawthorn, blackthorn)—*argue* the **need of protection** against insects or against browsing cattle.
STAGE II.—Growth and Structure of Stems.		
(1) By means of the **structure of the stem**, the whole vegetable kingdom is divided again into **three great classes**—	Telling.	(1) (*a*) *Describe* these, whether herbs, or shrubs, or trees, as having (i.) **woody bundles** arranged **round a central pith** of cellular tissue; (ii.) the whole **enclosed by** a layer of **bark**; *explain* that in the **first year** there is **no difference** in the growth of the stem of the herb and that of the tree; but in the case of the latter a **new layer of wood** is formed in the **second year**, between it and the bark; and so on, year by year, a new layer is formed.
(*a*) **Outward-growers** (exogenous plants).	Observation.	*Show* sections of **timber trees**—count **annular rings** to estimate years of growth, or **age**.
(*b*) **Inward-growers** (endogenous plants).		(*b*) *Show* a **cane** cut in section and split down. *Note* that there is **no separable bark and no pith**—that the **bundles** of woody **fibre run lengthwise**, and on the **cross section** the ends appear like so many **dots**.
	Telling.	*Tell* that the **additions** are chiefly made **towards the inside** —that the wood increases in amount as the stems grow older by the **formation of new woody fibres among the old.**
(*c*) **Summit-growers** (acrogenous stems).	Observation.	(*c*) *Exhibit* picture of **tree-ferns**. *Explain* that the **crown of leaves** at the summit is the **growing point**—that the **bases** of these leaves, or fronds, **join together** and so **carry upward** the growing point—such union **increasing the height** of stem.

Objects and Apparatus.—A variety of Herbaceous Stems, and Twigs of Trees ; Specimens of Wood : Bamboo, Cane, Flax, Hemp, Bark, Bast ; any or all of Specimens mentioned in Notes.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) Of the **inward-growers and the summit-growers,** most examples are peculiar to **hot countries.**	Supplemented by telling.	(2) *Instance* palms and **bamboos** as endogenous plants ; or (for our country) **grasses,** cereals, lilies, asparagus ; **ferns and mosses** as acrogenous plants.
(3) Of **outward-growers** the most **numerous** examples are to be found : **woody stems** have—		(3) *Exhibit* **specimens of timbers** (cross-cut sections) and **pithy twigs,** such as willows.
(*a*) **Pith** in centre.		(*a*) *Note* that in the **young** plant **pith is soft,** being necessary to the growth, as it contains **stores of food** ; but in **matured** trees it becomes a **mere thread** when no further need for it exists.
(*b*) **Wood.**		(*b*) *Again note* the rings denoting a year's growth—hardest part of wood near pith is called **heart-wood,** while softer outside layers are called **sap-wood.**
(*c*) **Bark,** in two layers—		(*c*) *Exhibit* specimens of **bark,** duly labelled ; also **bast fibre** (as used by gardeners), **hemp,** and **flax.**
(i.) Inner fibrous layer, called **bast.**		(i.) *Strip off* bark from a young twig (in spring) *to feel* **sticky fluid** between inner layer and woody centre—*teach* that this is the **growing part** which **forms** itself into **wood-fibres**—at first **soft sap-wood,** afterwards hardening into **dry tough wood.** *Instance* flax and hemp used in **manufactures** as merely examples of inner layers of bark.
(ii.) **Outer layers** (strong, **to protect** tree against damage).		(ii.) *Show* some **bark**—it is thick, **rough,** and strong —the inside growth has strained it till it has **cracked in all directions**—it **peels off** just as the skin of some animals is cast. *Exhibit* **oak-bark** (for tanning) and **cork** as common examples in daily use.

STAGE III.—Recapitulation and Additional Information.

	Questioning.
(1) The **work** of the stem is— (*a*) **to convey** food and water upwards from **roots to leaves,** (*b*) as well as **to support and lift up** the plant.	After questioning on foregoing, *add further information*, namely— (1) (*a*) *Gather* this from re-examination of any "**sapling**"—*show* that **sap is** really **earth-food** absorbed by root-hairs from the soil. (*b*) *Review* the introduction.
(2) The **uses** of stems to man are numerous and various; as for— (*a*) **Food.** (*b*) **Medicine.** (*c*) Manufactures.	Telling. (2) *Instance*— (*a*) Cane sugar; sago from stem of the sago-palm. (*b*) Quinine from sap of chinchona; camphor from the camphor-laurel of Japan. (*c*) Timber; tar and turpentine from pines; rubber, resins, and gums; cork and oak-bark; flax and hemp.
(3) The **stems of exogenous** plants generally **have branches**; while **endogenous and acrogenous** stems **seldom branch.**	,, (3) *Say* we may now consider **ornament** after dealing with utility—lead up to admiration of the **landscape,** the beauty of which depends so much on the mode in which stems and branches of trees develop. *Thus may be noted* **variety** of form in the **different habits** of the cedar, the spruce, and the poplar in giving off their branches. *Finally it may be noted* how these three kinds of stem structure correspond with those already mentioned in the Lesson on seeds; thus— Dicotyledonous plants have exogenous stems Monocotyledonous plants have endogenous stems } compared { **hardest** wood **inside** (as oak). **hardest** wood **outside** (as bamboo). Acotyledonous plants have acrogenous stems with the woody tissue in broken irregular circles outside the stem.

XXV.—LEAVES

Objects and Apparatus.—Leaves in great variety (scholars should be encouraged to select and bring their own specimens), particularly those undermentioned.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of Specimen Leaves.		
(1) The **parts** of a leaf are— (*a*) The **blade** (*lamina*). (*b*) The **stalk** (*petiole*), and (*c*) Sometimes a **pair of small leaves at foot** of stalk.	Observation.	(1) *Distribute specimens to examine* for the three parts, viz., blade, petiole, and stipules. (*Give names.*) (*b*) *Note* that **some** leaves have **no footstalk.** (*c*) *Name* these leaf-like expansions "**stipules,**"—*find* them well developed on the hawthorn.
(2) There are **two kinds** of leaves, viz.— (*a*) **Simple**—leaf all in one piece. (*b*) **Compound**—leaf split into divisions, each little leaf with a stalk.	Assisted by brief explanations and attempts at classifications.	(2) (*a*) *Instance* (as blades in **one piece**) oak, lime, holly, lettuce, cabbage, rhubarb. (*b*) *Instance* (as blades consisting of **more than one piece** (clover, horse-chestnut, rose). *Note* that each **leaflet is articulated** to the stalk.
(3) Leaves are **veined in different ways**; as— (*a*) Some have a **network** of veins (net-veined).		(3) *Examine* for **veins** by holding specimens **up to the light.** (*a*) *Instance* (as **reticulated**) the mallow, rose, lime. *Note* continuation of footstalk through middle of blade (the **midrib**) and then smaller ones **branching** out, and others from these.
(*b*) Some have no branching veins, but veins running **parallel** with central vein (parallel veined).		(*b*) *Instance* (as **parallel veined**) the grasses, flags, palm leaves. *Associate* net-veined leaves with dicotyledonous seeds and exogenous stem: parallel-veined leaves with monocotyledonous and endogenous plants.
(*c*) Some have **forked** veins.		(*c*) These are usually found on acotyledonous and acrogenous plants—*may be omitted here.*
(4) Leaves have— (*a*) **Various shapes** of outline.		(4) (*a*) *Name* **shapes** according to the **objects they resemble** (so far as specimen leaves go) as— Lance-shaped leaves in the wallflower. Spear-shaped ,, ,, dock.

		Arrow-shaped ,, ,, bindweed. Spoon-shaped ,, ,, daisy. Wedge-shaped ,, ,, horse-chestnut (leaflet). Heart-shaped ,, ,, lime. Kidney-shaped ,, ,, ground ivy. Egg-shaped ,, ,, birch. Needle-shaped ,, ,, Scotch fir.
(*b*) Their **edges** either **smooth or toothed.**		(*b*) *Instance* wallflower and clover with smooth margin; the oak, elm, rose, dandelion with notched or saw-like edges. *Note* **notches** of various shapes, some **directed upwards and some downwards.**
(*c*) Their **colours** in **various tints** of green.		(*c*) *Classify* by arranging groups— (i.) Those **nearly white.** (ii.) **Green above** and white underneath. (iii.) **Tinted with red** or purple (beet and copper beech).
(*d*) Their **surfaces** sometimes **smooth** and sometimes **rough.**		(*d*) *Pick out* leaves with **hairy** surface (as elm)—another group with **downy** surfaces (as fox-glove)—a group with longer hairs or **cottony** surfaces (as coltsfoot)—one with **rough uneven** surfaces (as oak)—and a group with **upper and lower surfaces differing.**
(*e*) **Regularity of arrangement,** on stem or branch; as— (i.) Opposite. (ii.) Alternate. (iii.) Whorled.		(*e*) *Note* first that **leaf buds** are produced at **regular intervals,** with a tendency to spiral arrangement. (i.) *Show* some leaves growing **opposite** each other, or on same level. (ii.) *Show* a branch growing, one leaf one side of it, and the next on opposite side **a little above it.** (iii.) *Show* a stem growing **leaves all round** it from a common joint.
STAGE II.—Questioning on Foregoing. (1) It is **to catch the most sunlight** that leaves— (*a*) Have their **various shapes,** and generally **horizontal position**; and	Questioning.	(1) (*a*) *Educe by questioning* that **leaves** hang in **horizontal** position to catch sunlight—that **great trees** with a mass of foliage **spread out their lower branches** for same reason. *Lead on* to recognition of **same cause** for **large trees** often having **small leaves** (as the birch), or compound **leaves**

LEAVES—*Continued*

Objects and Apparatus.—Leaves in great variety (scholars should be encouraged to select and bring their own specimens), particularly those undermentioned.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		much divided for **freer admission of sunlight**; as in— **Pinnate** (feather-like) leaves of rose or ash. **Digitate** (finger-like) leaves of horse-chestnut. } *Tell names* of these **two classes** of compound leaves. *Ask* why **grasses** may easily **grow so closely** together?—(Narrow blades, not flat, broad leaves.)
(*b*) Are **arranged** on stem (or branch) with **due regularity.**		(*b*) *Lead on* to a recognition of that **law of alternation** which has been noticed in arrangement of leaves, and in the **rounded stem** to permit of whorling leaves—that such arrangements are for **exposing leaves to light and air to very fullest extent.**
(2) **While** their **rough surfaces** are intended as **a protection.**		(2) *Gather* (*a*) that leaves **have enemies**; and (*b*) that some leaves **seek to protect** themselves; as thus— **Insects** eat fleshy parts—thus **hairs** on leaves tend to **hinder movements** of these destroyers. **Cattle** eat leaves—hence protection afforded by **downy** surfaces or by prickles, which **cattle refuse.** **Water** might **lodge** on leaves and **hinder their work**—if fine hairs did not **run it off quickly.**
STAGE III.—The Work of Leaves. (1) The water with its earthy salts **collected from the soil** by the roots is **passed on** by the stem **to the leaves.**	Questioning. Telling.	(1) *Inquire* what is the work of leaves? *Refer* to previous Lessons to gather that the **root-hairs suck up** nourishment from the soil; and that **stems pass it on** to the leaves. *Tell or gather* that this **sap is not in the proper form** to nourish the plant, that it contains **too much water,** and that it **needs something else** which the roots could not find in the

(2) The **work** of the leaves is to **manufacture a starchy food** for the sustenance of the plant; this it does **by the aid of sunlight.**		earth, but which the **leaves can obtain** in plenty **from the air** (carbon). (2) An herbarium or **glass shade** will *illustrate* the fact that leaves get rid of **superfluous moisture,** and do so **only** by the action of **sunlight—wet** will be **found** on the **inside** of the glass which covers plants **growing in the sunshine**; while that **kept in shade** will be **dry.** *Explain* that the **moisture is breathed out** of pores (or microscopic mouths), called **stomata**; that leaves also **breathe in** from the air **a gas** (poisonous to animals), and with the aid of water supplied by the roots, **change it into food** for the plant; that this **manufactured food,** and not the raw sap, is the **real nourishment** on which growth depends. *Explain* that the **flow of the sap** is effected by this **evaporation** at the **upper end** of the plant, *i.e.* in the leaves—as moisture **evaporates from one cell,** the water in the **cell below** is obliged to **come up one place,** and thus a **continuous movement is effected,** equivalent to the circulation of the blood in animals (effected by the heart's pumping).
(3) The **green colouring matter** of plants is also **dependent on sunlight.**		(3) *Exhibit* colourless or **blanched plants** grown beyond the reach of sunlight—as **hearts** of celery or cabbage **contrasted** with **unblanched outsides.**
STAGE IV.—Recapitulation and Additional Information. (1) The **leaves** of— (*a*) Some trees **fall off in the autumn.** (*b*) Others **remain green** during the **winter.** (2) Many **leaves** are **useful**— (*a*) **To man** for food, beverages, medicines, &c. (*b*) Feed **cattle** and innumerable other creatures.	Questioning.	After *review*, emphasising throughout the **dependence of vegetation upon sunlight,** may be *added*— (1) (*a*) *Instance* leaves of oak, ash, elm, and other "**deciduous**" plants. (*b*) *Instance* leaves of holly and ivy, and other "**evergreen**" plants. *Explain* that they do really fall off, but not till others have grown to take their place. (2) *Instance* cabbage, water-cress; tea; senna leaves; tobacco (a luxury). (*b*) *Question* on the support of **animal life** by a **vegetable diet.**

XXVI.—FLOWERS

Objects and Apparatus.—Flowers, numerous and various, sufficient for each scholar to have several; Enlarged Diagrams of the Parts of a Flower.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Examination of a Flower. (1) The flower is set upon a **flower-stalk**.	Observation.	(1) *Note* that some **flower-stalks** are considerably expanded for **reception** of floral organs. (2) *Give* all the **technical names** necessary; and always with their **alternative meanings.** *Examine* flowers to **find parts** named.
(2) When all the parts of a flower are present it is called a **complete** flower; otherwise it is said to be **incomplete**; the **parts** are—		
(*a*) The **calyx**, or cup, generally green; in leaflets called **sepals**.		(*a*) *Examine* some flower **buds** to see that the "**green cup**" or calyx **surrounds** all other parts. *Open* **calyx** with point of pen or knife. *Show* fuchsia for example of **coloured calyx.**
(*b*) The **corolla**, or crown, coloured; in leaflets called **petals**.		(*b*) *Having stripped off* **sepals** separately, let children *now pluck off* each gay-coloured **petal.** *Note* that petals are **arranged alternately with sepals**; in some flowers are separate, and in others more or less **united**, from the base upwards. *Note* differences in **colour**; also presence or absence of **perfume.**
(*c*) The **stamens**, or thread-like stems, having at the top of each a sac called the **anther**, which bursts when ripe and lets out some fine coloured dust called **pollen.**		(*c*) *Pick out* some **stamens** carefully. *Examine* the **two lobes** of the oblong pocket or anther. *Shake out* the **dust** on to white paper to see it better. *Remind* that children often **smear** themselves with the yellow pollen of buttercups. *Discover* some **stamens may be united** either by the stalks or by the anthers.
(*d*) The **pistil** is the central organ, and is a slender stem with a sticky knob (called the **stigma**) at upper end, and		(*d*) *Having stripped off* all the stamens, *come next* to the **pistil** in the **centre.** *Examine and name* the parts; *call* the stem or stalk of the stigma the **style.**

a thickened part (the seed vessel or **ovary**) at the lower end.		*Note* that **as pollen ripens, so does** the knot or **stigma**—it may become **rough**, or sometimes **hairy**, and becomes covered with a slightly **sticky** fluid. *Dust* some pollen on to the sticky stigma, *and notice* how it **adheres and mixes with it.** *Examine* the **swollen ovary** by cutting open and finding the **ovules** (or "young seeds")—this **seed vessel when ripe** forms the **fruit** of the plant, and in the fruit are found the seeds. *Note* that the **pistil** consists of modified leaves (called **carpels**), either separate, as in the buttercup, or united, as in the poppy; or sometimes one carpel constitutes the pistil, as in the pea. [*Next Lesson will deal with carpels.*]
STAGE II.—The Work of each Part. (1) The work of the **calyx** is to serve as a **protective covering.**	Questioning.	(1) *By questioning show* that the "green cup" is generally **strong.** *Liken* it to an overcoat **covering up** the more **delicate coloured parts** inside until they are ready to bear exposure to the air.
(2) The **work** of the **stamens and pistil is to produce fruit,** and consequently new plants.	Telling.	(2) *Question* on the **ripening** of the **anthers** of the **stamens,** and the **stigma** of the **pistil**—how one produced **pollen** and the other became **sticky.** *Explain* **processes** of fertilisation which now take place:—**anthers burst** open and **discharge pollen**—the scattered pollen **falls, or is carried,** on to the sticky moisture of stigma—the stigma **becomes active** and sends down **slender** tube-like **growths,** which force their way down the **inside** of the style until they **reach the ovules** inside the ovary—a little of the **vital fluid passes** from the pollen-tube **into the ovule,** unites with some of the juice of the ovule, and **forms a germ.** *Emphasise* the **great change** that has now taken place—the **ovule** has been **made fertile,** that is, has **begun to live,** has become a fruitful seed. Then, as the **ovary** grows and ripens, it forms the **fruit;** *dwell on* the absolute **necessity of contact** between pollen and stigma.

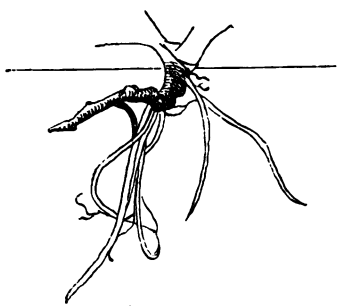
Objects and Apparatus.—Flowers, numerous and various, sufficient for each scholar to have several; Enlarged Diagrams of the Parts of a Flower.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) A plant is **made fruitful** by the **pollen** from the anthers coming into **contact** with the **stigma**; some plants are thus made fruitful by—		(3) *Examine* some flowers to find **differences in relative positions** of stamens and pistil—
(*a*) Self-fertilisation.		(*a*) If **stamens** stand **above pistil** so that **pollen may fall** on to stigma, then *proclaim* such plant a **self-fertiliser.** *State* that the **majority** of flowers **contain both stamens and pistil** (male and female organs).
(*b*) **Cross-fertilisation.**	Questioning.	(*b*) If **stamens stand below** the pistil, *ask* **how** the pollen is to be **carried upwards?** Or, as in the cucumber and pumpkin plants, the one stem produces **separate male and female flowers,** each containing one organ, **how** is the pollen to be **carried across?** *Gather or suggest* the **aid of insects**; *then ask* **what will attract** insects to flowers?
(4) It is the **work** of the **corolla** to **attract insects** to the flower, **to assist in fertilising** the plant; this is done by—		(4) *Ask* who has ever detected an **insect within the petals** of a flower, and what its presence signified? *Show* that a **flower flaunts** its colours on purpose **to attract** insects within it.
(*a*) Its **colour,** or	Telling.	(*a*) *Tell* that **some insects like one colour,** some another—**some one species** of flower, some another—that **all** insects **like honey,** and would take it **if they could reach it**—but some flowers are provided with **contrivances** such as slippery petals, sticky surfaces, hairy barriers, narrow openings, and so on, which **keep out undesirable insects,** and **let in** those who are really **useful**—who **get smeared** with pollen, and **carry** it to the stigma of a similar flower, and so

(*b*) By its **perfume.**

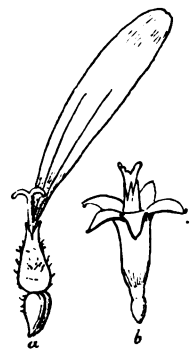
fertilise it—the **assistance** is thus **mutual,** for insects secure **food** and plants **fertilisation.**

(*b*) *Show* that **colour** would be of **no use** for attracting **night-flying** insects like moths—hence **night-flowers** (as Evening Stock) have white flowers, but **a strong perfume to attract** night-fliers. *Contrast* with **daisy,** which shuts up at night to exclude undesirable night-fliers, whose aid it does not need.



Daisy Root.

The Daisy.



a=ray floret (white).
b=disc floret (yellow).

FLOWERS—*Continued*

Objects and Apparatus.—Flowers, numerous and various, sufficient for each scholar to have several ; Enlarged Diagrams of the Parts of a Flower.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(5) **Colourless flowers** do not require the presence of insects ; their **pollen** is **scattered** by the agency of the **wind.**		(5) *Instance* the flowers of the oak and the fir ; and particularly of the **grasses**—*discover* what is happening to ripe mowing grass at **every breeze which sways it** to and fro.—(Fertilisation by action of wind.) *It may be educed* that the **waste of pollen** caused by wind, rain, and dew, especially with flowers having open corollas, is **very great** ; and hence the **large number of stamens** some of them possess.
STAGE III.—Recapitulation and Additional Information. (1) Flowers have a **use** for **man** ; as for medicine, perfumes, food. (2) Flowers add to the **enjoyments** of **life** by their colour, or by their perfume.		After recapitulatory *review*, in which *questioning will show* how flowers differ from each other in **size, shape, colour,** and **structure,** with reasons for such **divergencies**, *it may be added*— (1) *Find* names of **herbs** (camomile, yarrow), of **scents** for which flowers are utilised (attar of roses, lavender water), and of flowers **eaten** (cauliflowers), or used in **beverages** (hops). (2) *Question* on **decorative use** of plants and cut flowers, and the delight of a nosegay, whether of garden or of wild flowers.

XXVII.—FRUITS

Objects and Apparatus.—Fruits, Nuts, Berries, Pods, Seeds of every available kind, supplemented by Coloured Pictures of the undermentioned fruits not obtainable.

INTRODUCTION—

From previous Lessons *recall* that the **fruit** is the **seed-vessel** or the **matured ovary** and other parts. *Exhibit* a number of **ripened seed-vessels** to the class, *and have them named ;* as apple, plum, nut. What are these called ?—(**Fruits.**) *Then show* some pods of peas and beans. What are these called ?—(**Vegetables.**) *Prove* that **both sets are seed-vessels,** of which the **pips** of the apple, the **stone** of the plum, the **peas** and the **beans** are **really the seeds.**

Next revert to the **receptacle** and **calyx** of the blossom; and *particularly to* the **ovary** forming the base of the pistil, and consisting of one or more **carpels**.

State that **after fertilisation** the **ovary** is called the **seed-vessel**, and the **ovules** become **seeds** in name: but **before** the young seeds **arrive at maturity** many important **changes** take place in the **parts** which **enclose and protect the seeds**: that *our Lesson will show* how these parts grow into "**fruit.**"

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Formation of Fruits. (1) The **walls of the carpels** consist of three layers— (*a*) The **endocarp**, or inner layer. (*b*) The **mesocarp**, or middle layer. (*c*) The **epicarp**, or outer layer. (2) **Fruits** formed by the pistil **of one flower** are called **simple**; those formed from the pistils of **several flowers** are called **multiple.**	Observation.	(1) *Admit* that these parts are **not easily distinguishable** in the **early stage**, but a **ripe fruit** will show them; as in a plum or cherry. (*a*) The **hard shell** which encloses the kernel or seed is the **endocarp.** (*b*) The **juicy pulp** we eat is the **mesocarp.** (*c*) The thin outer **skin** is the **epicarp.** } *Give these technical names.* (2) *Instance* as **simple fruits**, gooseberry, apple, haw. ,, ,, **multiple fruits**, mulberry, pineapple, cone, fig. *Note* that it is **immaterial** whether the pistil was formed of one or of several **carpels.**
STAGE II.—Classification of Fruits according to Formation. (1) **Simple fruits** are— (*a*) Those formed from the **ovary and the calyx** grown together (or **fleshy fruits**); as (i.) **Berries** (with soft pulp and small loose seeds). (ii.) **Gourds.** (iii.) **Pomes** (with firm, hardish pulp).	Observation of specimens named and classified by Teacher.	(1) (*a*) *Trace* the **development** of the **calyx** (as peel or rind) and the **pistil-enlargement** in these. (i.) *Instance* gooseberry, currant, grape, with a soft **pulpy portion** formed from the **endocarp**, the **skin** being formed by the **epicarp and calyx** grown together. (ii.) *Instance* the cucumber, melon, vegetable marrow—**same formation** as the berry, but with a **hard rind.** (iii.) *Instance* apple, pear, hawthorn, formed from a **compound pistil** (several carpels) with a **coherent**

FRUITS—*Continued*

Objects and Apparatus.—Fruits, Nuts, Berries, Pods, Seeds of every available kind, supplemented by Coloured Pictures of the undermentioned fruits not obtainable.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		calyx-tube; it is the latter which **grows thick and fleshy**, and makes the eatable part of the fruit. *Examine* apple to disclose that the real **seed-vessels are five** in number, enclosed in **parchment-like walls**; and immediately surrounding the seed-vessels note a **circle of greenish tint**, which is the flesh of the **core**, formed from the **enlarged receptacle** of the flower—these seed-cells corresponding with the carpels.
(*b*) Those formed from the **simple ovary**; as		(*b*) Trace the formation of stone from the endocarp, &c. (as in Stage I.).
(i.) **Stone-fruits**, or **drupes** (with soft pulp and single stone).		(i.) *Instance* plum, cherry, peach, almond (in the almond the middle part is leathery and not juicy). *Note* that so far (that is, in dealing with **stone-fruits** and **fleshy fruits**) we have had only **indehiscent fruits**, or those which remain closed till the seeds begin to grow, or until the seed-vessel decays. *But now we come to* **dry fruits**, which may be either **dehiscent or indehiscent.**
(ii.) **Dry fruits**, having no soft fleshy layers; some of which **split open** (dehisce) for the discharge of their seeds—		(ii.) *Instance* these under **two classes**, namely—
(i.) In a **regular way** (as **pods**).		(i.) The dehiscent dry fruits, such as **pods** formed from **single carpels**, and which usually **split open lengthwise** when ripe and dry (as the pea family):

(ii.) In a **variety of ways** (as **capsules**).		(ii.) The dehiscent dry fruits, such as **capsules**, formed from **compound pistils** and which **dehisce in various ways**; thus the **poppy-head** when ripe develops little cracks all round the top, through which the seeds may be shaken, as from a castor; or the bursting pods of **wall-flower**, &c.
Other dry fruits are **indehiscent** (do not split), as **nuts**, one seed with dry hard covering; **grains**, clustered seeds in husks, &c.		*Instance* among the indehiscent dry fruits— The **achenes**; or dry, one-seeded, closed small fruits like naked seeds (buttercups). The **grains**; same as achenes, except that the seed-vessel adheres to seeds (oats). The **nuts**; a hard and larger achene, the hard seed-vessel being a shell (cob, filbert). *Note* some achenes with **winged appendage**, generally called "key" fruits (ash, maple).
(2) **Compound fruits** are those formed— (*a*) From a **cluster** of **pistils**, or (*b*) From a **cluster** of **flowers**; or are less simple in formation, each multiple fruit being **an aggregation** of small fruits called **drupels**.		(2) (*a*) *Instance* the **blackberry**, formed from the **numerous pistils** of a single flower. (*b*) *Instance* the **mulberry**, in which the juicy pulp is produced from the **calyx of each flower**, and not from the pistil, as in the blackberry—the real fruit is an embedded achene. *Compare* **drupels** (or "little drupes") of a blackberry with **drupes**, as of any member of the plum family—all fleshy and juicy, but **differing in size and shape.** *Exhibit* the **strawberry** as a good example of the accessory fruit—the soft **fleshy part** is simply the **receptacle grown large and juicy** (so that it is not a berry at all), and scattered over it are the **real fruits**, small dry **achenes.**
STAGE III.—The Uses of Fruits and Seeds. (1) To the **plant**—to **produce other plants** exactly like it.	Questioning.	(1) *Gather* this **primary use** from children's own knowledge. *Then note* two **exceptional processes**, viz.: (*a*) A fern spore is not exactly a seed, for it produces not a fern but a green leafy expansion called a prothallium;

FRUITS—*Continued*

Objects and Apparatus.—Fruits, Nuts, Berries, Pods, Seeds of every available kind, supplemented by Coloured Pictures of the undermentioned fruits not obtainable.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		this plant develops a fern, so that each individual is "different from its mother, but exactly like its grandmother." (*b*) **Cultivated fruits**, improved by the art of horticulture, are only **kept up** by good soil and the **grafting** of the improved variety on well-grown stocks; thus our fine **apples** would **revert** to the original **crab** if sown in ordinary poor soil.
(2) To **man**—as food.		(2) *Let children instance* { "fruits" (apples, currants), "vegetables" (peas), "grains" (rice, nuts).
—For beverages.		Coffee and cocoa seeds; malt; apples (cider); grape (wine).
—As medicine.		Oil from castor seeds.
—In manufactures.		Oil from hemp and flax seeds.
(3) To **animals**—as cattle food, bird seed.		(3) *Let children instance* beans for horses, grains for poultry and birds, &c. *Note* the **excess of seeds** produced to permit of these **secondary uses**.

CONCLUSION.—*Make a test exercise.* (1) to group or classify all the available specimens **according to the uses** (as in Stage III.). *Then a more difficult exercise*, (2) to group specimens or pictures **according to their structure** (as in Stage II.)—first dividing the simple from the multiple fruits; then placing the dry fruits (for subdivision afterwards) alongside the stone-fruits; and making another group of the berries, pomes, and gourds. *Note* the misuse of "berry" in such a name as strawberry. *Distinguish* fruits which are **wild** from the **cultivated**, and the **native** from **foreign**.

XXVIII.—SEASONS OF THE YEAR

Objects and Apparatus.—An Almanac; Pictures of the aspect of the Seasons; of Agricultural Implements and Machines; and of Farm Work (as Shearing, Sowing, &c.).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Winter, the Season of Rest.		
(1) Winter is the **coldest season** of the year; the winter months are January, February, and March.	Telling and Questioning. Supplemented by descriptions of pictorial illustrations.	(1) *Introduce* by asking for **names** of the **months** and of the **seasons**. *Then apportion* the **first three months** to winter; admit that **December** is often reckoned **a winter month**. *Declare* winter to **commence** on December 21st (shortest day) and to **end** on March 21st.
(2) **Farm work in winter** consists mainly of—		(2) *Contrast* **town and country** for observing the work of **nature**.
(*a*) **Steading** (work close around the homestead; sheltering animals in sheds).		(*a*) *Explain* the **winter feeding** of cattle with **roots** at the farmstead—not now by grazing in the open. *Educe* that as **feeding** stock **in their stalls** necessitates use of much **straw**, winter is a good time for **thrashing** grain and sending it to market.
(*b*) **Ploughing.**		(*b*) *Compare* ploughing with **spade-digging**—preparing land, by **breaking it up**, for the reception of seeds—especially the **burying of stubble** left by reapers, and the **ploughing in** of **manure**, carted on to the land in winter. *Educe* that a severe **frost** hardens land and **prevents ploughing**; but **does good** by crumbling the soil in the thaw.
(*c*) **Hedging and ditching.**		(*c*) *Describe* these occupations as useful in filling up **odd times**—**hedges** need **cutting** and timber felling where land is over-shadowed too much, and fences repairing where broken down—**ditches** need cutting and **clearing out** to drain the land, as stagnant water is harmful to crops.
(*d*) **Tending lambs.**		(*d*) *Name* **February** as chief month in which **lambs are born**; and *gather* that **shepherd** will need to be very **busy** night and day to **shelter** ewes and lambs from frost.

Objects and Apparatus.—An Almanac ; Pictures of the aspect of the Seasons ; of Agricultural Implements and Machines ; and of Farm Work (as Shearing, Sowing, &c.).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(3) **Vegetable life** is at its **lowest**, and **Wild animals** find it more **difficult to live.**		(3) *Describe* winter as the season when **plant life rests.** *Discover* how **few** seasonable **flowers** can be named (Christmas rose, snowdrops, crocus). *Gather* that the **birds** approach the **habitations of man**, the robin becoming particularly tame ; while **hares** and rabbits enter **gardens** to feed on cultivated vegetables, and **foxes**, pole-cats, and weasels rob the farmers' **hen-roosts**—all **food being scarce** in winter time.
STAGE II.—Spring, or Seed Time. (1) Spring is the season of **returning life** ; the spring months are April, May, and June. (2) **Farm work in spring** is at its **busiest** ; it is the time for (*a*) **Sowing seeds.** (*b*) **Tending the growth.** (*c*) **Tending calves**, and **shearing sheep.** (3) **Vegetable life awakens** from its winter sleep ; as seen in— (*a*) The springing **grass**, green herb, and **wild flower.**	As before.	(1) *Say* that after the season of rest, **plant life wakens up** in spring, which lasts from March 21st (spring equinox) to June 21st (longest day). (2) (*a*) *Instance* **March** as the principal **seed-sowing month** for spring wheat, oats, barley, and for planting potatoes ; the **turnip lands**, bared by the sheep, now intended for wheat, beans, or barley, and other fields intended for root-crops, are all **prepared by ploughing** and harrowing. (*b*) *Instance* the **cleaning of the land** by harrowing, the **stone picking**, the **rolling** of grass lands, and the **hoeing** of fields containing **crops** planted by **drills** in rows. (*c*) *Name* early spring for looking after the young **calves** and their mothers. *Name* the warm days of June for washing and clipping sheep and gathering in the **wool crop.** (3) *Connect* the word **spring** with its literal meaning—the "**springing" up time.** (*a*) *Let children name* some **spring flowers** ; as primrose, violet, cowslip.

(*b*) The **leafing** of the trees.		(*b*) *Let class try to arrange* trees in the **order of their leafing**, beginning with the **soft** and going on to the **harder woods**; as willow, poplar, and alder to the oak and ash.
(*c*) The **blossoming** of the trees.		(*c*) *Draw on children's experience* of **fruit trees in blossom**, or at least of the "**may**" on hedgerows, or **laburnum and lilacs** of town gardens.
(*d*) The incoming of **fresh fruits** and **green vegetables**.		(*d*) *Draw on children's experience* of seasonable appearance of new potatoes, **salads**, peas, and **green vegetables** (replacing root vegetables preserved through the winter), and of **strawberries**, the forerunner of fruit crops.
Animal life is largely **increased** by—		
(*a*) **Young stock** born on the farm.		(*a*) *Revert* to lambs and calves already mentioned—*add* **colts, chickens**, and other new-born stock.
(*b*) The **young** of woodland **animals**, of **birds**, and of **insects**.		(*b*) *Specify* the young of hares, foxes, &c., of wild birds, and of various insects produced in spring.
(*c*) The **return** of the **birds of passage**.		(*c*) *Allude to* the return of the swallow, the cuckoo, and other **migrants**; and to the **salmon** coming up the rivers to spawn.
STAGE III.—Summer, the "Sunny" Time.		
(1) Summer is the **warmest season** of the year; the summer months are July, August, and September.	As before.	(1) *Fix* summer period as lasting from June 21st (longest day) to September 24th (autumnal equinox). *Associate* the term summer with the "**sunny**" **time** as opposed to winter, the "**windy**" **time.**
(2) **Farm work in summer** consists mainly of—		
(*a*) **Grazing** the stock.		(*a*) *Elicit* that spring has produced good **pasture**—that animals are fed **in the open** as soon as possible—that **horses and sheep bite low** and therefore should not be turned out together—that either one or other graze better with **cattle** which **bite the grass high**. (*Note* that **turnips** are **now sown** on the prepared lands for their **winter keep.**)
(*b*) The **hay harvest.**		(*b*) *Gather* that this is the **first of the harvests**, the hay being mown about July—the **meadows** or low-lying fields being those left **ungrazed**, and reserved **for the scythe.**
(*c*) The **corn harvest.**		(*c*) *Gather* that the hot **August sun** has dried and **ripened**

Objects and Apparatus.—An Almanac; Pictures of the aspect of the Seasons; of Agricultural Implements and Machines; of Farm Work (as Shearing, Sowing, &c.).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
		the grain, ready for September cutting—the greater harvest. (*Note* that **rick-yards** are now full again.)
(3) **Vegetable life** is everywhere **rife**;		(3) *Let class enumerate* season's **wild flowers**; as fox-glove, poppy, and other bright-coloured flowers; *describe* the **tangle** of the **hedgerows** with honeysuckle, convolvulus, and climbing plants of all sorts; the brilliance of **heath and common** with broom and gorse and heather; the luxuriant greenery of the **ferns**, and the appearance of **fungi**.
And **animal life** is **even** abundant **in the air**.		*Allude to* **prevalence** of butterflies, moths, and other **winged insects**, some of which prove **troublesome** to man and beast, during the hot season.
STAGE IV.—Autumn, the Harvest Time.		
(1) Autumn is the time for **ingathering** all the produce which still remains out, and the **completion of the year's farm work**; the autumn months are October, November, and December.	As before.	(1) *Suggest* the literal meaning of Autumn to be "**time of produce.**" *Discover* that in addition to the hay harvest and the corn harvest, there remain the ingathering of— (i.) **Orchard fruits** (in warmer countries the **vintage** is reached). (ii.) **Root-crops**, as beet, swede, carrot, and potato, which are stored in **barn**, or else **hogged** (*i.e.* covered with straw and buried in dry soil). *Note* that December is fairly in the winter, and Christmas is regarded as the **winter holiday.**
(2) The **work of the farm** is mainly to make everything **snug and secure** against the **wintry weather.**		(2) *Mention* that in ancient times **root-crops were unknown**, and as there was therefore no winter keep, **cattle** had to be **slaughtered** in large quantities in the autumn, and **salted** down.

(3) **Vegetation** has assumed its **autumnal tints** of yellow, red, and russet; the hedgerows produce **berries**; fruit and forest trees **drop their leaves**, and only the **evergreens** are left to **relieve the bareness**.	*Enumerate* other **preparations for winter**, as the **felling of trees**, repairing of **sheds and outhouses**, **ploughing** of stubble fields for **winter fallows**, carting **manure**, and cutting **drains**.
Summer migrants have departed, the **winter migrants** begin to arrive, and creatures which **hybernate** commence their winter sleep.	(3) *Paint* the glowing **richness** of autumnal **tints and ripe berries**, and the softness of a woodland **carpet of fallen leaves**.
	Let class name some **evergreens**.
	Let class name **summer migrants** (swallow, martins, &c.), **winter migrants** (as fieldfares, wood-cock, wood-pigeon, wild duck), and **hybernating creatures** (as bat, squirrel, snake, frog).

CONCLUSION.—In review, *teach* names and dates of the **quarter-days**; *explain* the **lengthening and shortening of daylight** during the year; and *touch upon* the **close and the open seasons** for shooting and fishing, and generally upon hunting **seasons** alternating with **breeding seasons.**

XXIX.—NATIONAL FOODS

Objects and Apparatus.—Samples of Cereals (grain and meal); Bread (white and brown); Pictures of Food-Plants dealt with; a Basin of Water, and a Muslin Bag of Wheaten Flour; Corn-Flours (various).

INTRODUCTION—

By rapid questioning show—that our **diet** is a **mixed** one, consisting partly of foods of an **animal origin** (as butchers' meat, bacon, milk, cheese, eggs), and **partly of vegetables** (as wheat, peas, cabbage, turnips); that whereas a **flesh food is higher-priced**, and by itself less wholesome, **vegetable food** is not only **cheaper**, and more readily procurable by the mass of the population, but if properly **selected and mixed** will **maintain human life** in its full health and vigour.

Tell the **threefold work** food has to perform, viz.—

(1) To form or **build up the body**,
(2) To **maintain the heat** of the body,
(3) To **produce force** to enable the body to do work,

} although **few foods** singly can **perform satisfactorily** all the functions of { flesh-formers, heat-givers, force-producers, } and hence **mixed diets are best.**

NATIONAL FOODS—*Continued*

Objects and Apparatus.—Samples of Cereals (grain and meal); Bread (white and brown); Pictures of Food-Plants dealt with; a Basin of Water, and a Muslin Bag of Wheaten Flour; Corn-Flours (various).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Staple Foods (generally).		
(1) Almost **every country** provides **some product,** which with care and industry will **furnish the means of sustaining human life.**	Questioning and Telling.	(1) *Question out or tell* the **staple foods** which are **better known**; as— (*a*) The **wheaten bread** of **England.** (*b*) **Oatmeal,** in cake or porridge, in **Scotland.** (*c*) **Potatoes** in **Ireland.** (*d*) **Dates** in **African deserts.** *Show* that staple foods are **mainly vegetable** foods (**all** we eat is **of vegetable origin,** inasmuch as animals derive their support from plants), and *tell* that we shall find that **cereals** (or corn-grains) **provide the staple food** of **four-fifths** of the **world's population.** *Note* **exceptional** case of the **Esquimaux** who thrive on a **diet of fish and whale-oil**—vegetation fails in their ice-bound regions.
(2) The **same food** will **not suit all nations,** because **different degrees of heat and cold** influence the bodily frame in such a way as to make different kinds of food necessary.		(2) *Argue* that as **Esquimau relishes and thrives** upon rancid train-oil, oils and **fats** must **suit cold countries**—in fact, they are **heat-givers.** *Remind* of our **repugnance to fat** in the hot **summer weather.** *Argue* that in **hot climates** people **do not need,** and do not eat, **fatty foods.** *Explain* that **people** who inhabit the **hot regions** of the earth are **unable,** from the nature of the climate, **to undergo** such **bodily and mental labours** which form the everyday life of men in more temperate climates, hence their **bodily wear and tear are less**—hence again the **need of nutrition** is also **less,** so **they use a food** (i.) which contains very **little fat,** (ii.) is very **easily digested,** (iii.) which **meets the relaxing nature** of the climate, (iv.) which is **easily cultivated,** and

		(v.) which is mainly a **force-producer**—the most **natural food** for such a region is the **rice** eaten in East.
(3) **Whatever food** is— (*a*) Easily and **cheaply procurable** by the mass of the people, and is— (*b*) **Suited to the temperature** of the region, **Becomes the staple food** of the country.		(3) *Make this deduction* to follow from the preceding work. *Help class to state* how each of the aforementioned **national foods fits these conditions.** For instance— (*b*) The **relaxing** effect of **oatmeal** suits the cold **bracing air** of **Scotland.** *Explain* how **deficiencies** in each **are met.** For instance— (i.) The **potato** is largely **water and starch,** therefore the Irish have to eat large quantities, and **eke out** its deficiencies by cooking the skins, and adding skim-milk, or occasionally bacon. (ii.) **Oatmeal** contains **all the elements** of a good food, but scarcely in the right proportion—the Scotch become very muscular on it, as its **gluten** is excellent for **muscle-making.**
(4) Most convenient, and very largely used, are the **farinaceous foods**; either as—	Observation.	(4) *Distribute* for examination **grains** of wheat, oats, barley, rice, and maize; samples of **tapioca**, sago, arrowroot. *Derive* **name** from *farina*, L. for "flour," because **all** these can be made into **fine meal.** *Describe* them **all** as **starch foods**, but the **grains** as **having gluten.**
(*a*) **Corn-grains** (containing **starch and gluten**); wheaten flour = 12 per cent. gluten; oat meal = 18 per cent. gluten; rice = 6 per cent. gluten; or	Experiment.	(*a*) *Cut open, and send round the class,* some **wheat grains**; *pointing out* that the inner **white substance** is the **starch** (force-producing and heat-giving) and the **outer brown** coating is the **gluten** (flesh-forming)—hence brown **whole meal** bread is the **more nourishing.** *Experiment*—wash a **muslin bag** of wheaten flour in a basin of **clean water**; the **starch** has **washed out,** leaving **behind** in the bag a white **sticky substance,** which is **gluten.**
(*b*) **Preparations** such as tapioca and sago (pure **starch alone**).	Telling.	(*b*) *Describe* these as quite **devoid of flesh-forming principles**—therefore of **little value** as food **unless** used **with tissue-forming and fatty substances**—alone they are incapable of supporting life.

Objects and Apparatus.—Samples of Cereals (grain and meal); Bread (white and brown); Pictures of Food-Plants dealt with; a Basin of Water, and a Muslin Bag of Wheaten Flour; Corn-Flours (various).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE II.—Some National Foods. (1) **Wheaten bread** is the national food in **England.**	Observation, Questioning, and Telling.	(1) *Exhibit* ears of wheat, wheaten grain, flour, bran, white bread, and brown bread. *Question* rapidly on—**grass-like** appearance of young wheat—its identity as **a cultivated grass**—its **ripening—cutting**, thrashing, grinding (white grain into **flour** and husks into bran)—**kneading** into light **spongy bread** by addition of yeast—**baking**—different **qualities of bread.** *Elicit* that **whole-meal bread** is more nutritious than bread of fine white flour from which the **miller** has **sifted out** the brown outside skin or **bran,** containing the nutritive flesh-forming portions (gluten), leaving only the white or starchy portions. *Explain* that we speak of **"our daily bread"** because bread is a typical standard food—man in all parts of the world makes bread of some kind his staple food.
(2) **Rice** is another grain food, and is used in the **Far East** by one-third of the entire human race.		(2) *Exhibit* some rice grains, oats on the straw, and pictures of the rice plant and oat plant. *Run over, by questioning,* the **properties of rice** as a food-plant (Stage I.). *Describe* **rice**-growing—sown on **flooded lands**—preference for **moist soils** in hot countries—its handsome **clusters of yellow-husked grains**, like our own beautiful "dancing oats"—called **paddy** while growing—**separation of husks** and grains—chief food in **India, China, and Japan**, where it is a **necessary**—used **here** only as a **luxury** in puddings.
(3) **Maize** or Indian corn is largely cultivated and eaten in **America.**		(3) *Exhibit* maize cobs, corns, hominy (split maize), pop-corn (roasted corns burst), and corn-flours.

Tell briefly—**maize** is a **grass** growing to **height** of eight feet —grains ground and boiled form "**mush**," a **favourite** food in **U.S.A.**—in **Italy** it goes under the name of "**polenta**"—in **England** it is ground into **corn-flour** and used in such preparations as "oswego" and "maizena." [England].

(4) **Millet** grain is largely used for human food in **hot countries.**

(4) *Exhibit* some grains of **Turkish millet** (used as a poultry food in *Tell*—**several plants** of the grass tribe **yield millet**—**grains** of some are white, some white with black spot, a third black, and a fourth red—**durra** or Turkish millet makes a **fine white** flour—used extensively as human food in **Turkey and Northern Africa.**

(5) **Coarser bread** made from the grains of **hardier plants** is eaten in some **countries** which are **too cold** for the **ripening of wheat.**

(5) *Exhibit* grains and meal of oat, rye, barley, buckwheat, and specimens or pictures of the plants.

Refer to the **oat food** of **Scotland** (Stage I.)—a very nourishing and **laxative** food in a cold **bracing country**—**oat-flour cannot** alone **be made** into **bread.**

Add—**rye bread** is dark, heavy, and sourish, known as black bread, is a favourite food of **Northern Europe**; **barley bread** was largely used in **ancient times**; **buckwheat** is **not a grass**, but its starchy seeds sometimes form a human food.

(6) **Prepared starchy foods** very largely eaten are—

(6) *Exhibit* some tapioca and sago.

(*a*) **Mandioca**, in **South America.**

(*a*) *Explain* that the **mandioca** is **poisonous** when **growing** —its big **roots** yield a nutritive **starch** which **exposed to fire** becomes **harmless**—as **mandioca meal** it is eaten as chief food in South America—more **carefully prepared** it is used by us as **tapioca.**

(*b*) **Sago**, in Malay and the **Indian Islands.**

(*b*) *Explain* that this **pith** of a beautiful **palm** is rich in **starch** which is **separated** by washing with cold water—this starch is afterwards **dried and passed through sieves**, and thus **sago grains** are formed.

CONCLUSION—

Review to show that the "**staff of life**" is generally a **vegetable**—a starchy food (both a heat-giver and a force-producer), and most frequently a **cereal.**

Admit that **nature's model foods**, having all elements in the right proportion to sustain life, are **animal products**, namely, **milk** and **eggs**—hence the **advantage of mixed diet** when the staple food does not contain all requisites, or does not contain them in the right proportion.

XXX.—PLANTS WOVEN INTO FABRICS

Objects and Apparatus.—Samples of Raw Material, Fibre, and Spun Thread, and of the various manufactured products dealt with under the headings of the four plants named; Wall-pictures or Specimens of the Plants; three Thermometers and some Boiling Water; a Piece of Fur.

INTRODUCTION—

Question on the **clothing** of **animal origin**, as silk, wool, leather, furs, felt; *lead* to the discovery of **clothing** derived from **vegetable sources**, as cotton, linen, straw-plait. *Question in a general way* on the **processes** of spinning and weaving; *distinguish* from the process of machine-knitting (a kind of chain-stitch quite unlike the crossed threads of woven goods), which produces hosiery, *i.e.* stockings, jerseys, mufflers. *Make only a passing allusion* to **mineral sources** of clothing (as in armour, shoe-tips, hooks and eyes).

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
STAGE I.—Cotton.		
(1) A great **variety of fabrics** are made from cotton.	Questioning, Telling, and Comparison.	(1) *Let class name* some **textile** fabrics; then fabrics of **cotton only**. *Pass round* **samples** of calico (bleached and unbleached), prints, muslin, fustian (such as corduroy, moleskin, and velveteen, heavy materials used for working-men's suits). *Compare* **weights** of muslin and fustian.
(2) The **properties of cotton**, as a material for clothing, are—		(2) *Help children to discover* the various **properties** by handling the specimens.
(*a*) It is **soft and pliable**;		(*a*) *Discover* **softness** from comfort with which cotton can be **worn next the skin.**
(*b*) **Easy to wash**;		(*b*) *Note* that it **shrinks but little** in washing (unlike woollen goods); makes a **clean "wear."**
(*c*) **Conducts heat** better than wool, and therefore makes a cool and **pleasant wear in hot countries**;	Experiment.	(*c*) *Experiment*—plunge **three thermometers** into boiling water, and each will mark 212°; take them out quickly, **wrap** one in fur, one in flannel, and one in calico. After ten minutes examine to note height of mercury in each—the one wrapped in fur will show greatest heat, and that in **calico least**, proving that cotton allows heat to **escape more freely** than other two.

(*d*) And being **cheap**, it is **largely used** all over the world.

Questioning, Telling, and Comparison.

(*d*) *Compare* current **price** of calico with that of other materials. *Discover* its **frequent use** in all our clothing (silesia and other **cotton linings** for costlier fabrics). *Tell* of its extensive **exportation** (value £60,000,000 per annum, after retaining all the cotton goods needed for own use).

(3) The cotton plant **grows** in most of the **hot countries** of the **Old and the New World.**

(3) *Specify* **chief countries**—United States, India, China, Egypt. *Describe* the plant as an **annual** of the same order as the holly-hock, growing from **two to four feet high**, and bearing **yellow flowers.**

(*a*) The cotton is **the downy covering** of the seeds in the pod.

(*a*) *Recall* Lesson on **flying seeds.** *Exhibit* a cotton **pod or boll.**

(*b*) It is **picked** by hand in the autumn.

(*b*) *Tell* that the **pickers** are women or children, each **gathering** 200 lbs. a day, **pulling it out** of the bolls.

(*c*) And after **separating** the seeds in a **gin**, the "lint" is **packed** into **bales** for sending away.

(*c*) *Tell* that the **ginning** is done by a **machine** on the **plantation**—that the "**lint**" **or raw cotton is packed very tightly** into 350 lb. bales for transit across the sea.

(4) Cotton **manufacture** is carried on mainly in Lancashire.

(4) *Question* on the **cotton trade** of England—the two receiving ports—the **towns** engaged in the trade.

(*a*) The raw cotton after **cleaning**, **sorting** the fibres, and **carding** or drawing them out straight, is **spun** or twisted into **yarn.**

(*a*) *Briefly deal with* **sorting** of the long and short "**staples,**" and with the spinning or twisting of the fibre into **one long thread**, and the making of the **yarn** into **hanks.**

(*b*) The **yarn** is **woven** into cloth material on a **loom.**

(*b*) *Examine* a piece of **calico cloth** to see how it is built up of **threads interlacing at right angles**—*unrove some—call* the long threads the **warp**, and the short crossing threads the **weft.**

Exhibit **specimens** of material in which the yarn was **dyed before weaving**, as gingham.

Exhibit **specimens** of material in which the yarn was **dyed after weaving**, as silesia.

Exhibit **specimens** of **print** on which the pattern has been printed from **engraved rollers.**

Exhibit **specimens** of material, **part cotton and part wool**, as wincey.

Objects and Apparatus.—Samples of Raw Material, Fibre, and Spun Thread, and of the various manufactured products dealt with under the headings of the four plants named; Wall-pictures or Specimens of the Plants; three Thermometers and some Boiling Water; a Piece of Fur.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(5) Cotton is the **most important** of all **English manufactures.**		(5) *Re-quote* figures previously given—*note* that cotton manufacture **stands before the other two staple trades**—wool and hardware—the **output** of cotton cloth being ten million yards per day in a busy time.
STAGE II.—Linen. (1) Linen is a **more expensive** material than cotton.	Questioning, Telling, and Comparison.	(1) *Distribute* **samples** of linen, holland, diaper, damask, duck, huckaback, drill, shirting, cambric, lawn, sewing-thread. *Gather* that linen is **not in such common use** as cotton —*and infer* that if its **qualities** are **not inferior**, it must be **higher in price.**
(2) The **properties of linen**—		(2) *Help children to discover and describe* the various **properties** by handling the samples.
(*a*) It is **softer** than cotton, has a **finer texture** and a **smoother** surface;		(*a*) *Demonstrate* its **softness** to sense of touch—*note* that for pocket-handkerchiefs and towels, used **frictionally** against the skin, it is **universally used**, although now less used for body linen on account of its cost. *Ocularly demonstrate* texture of "**fine linen.**" *Feel* smoothness of **surface**—remind that **starched wear**, such as cuffs and collars, is invariably of linen, because it "takes the starch" better than cotton; the latter having **crinkly fibres** (seen under microscope), whereas linen fibre is perfectly straight **and smooth.**
(*b*) And its **strength of fibre** makes it **more durable.**		(*b*) *Test* strength by tearing linen and then calico. *Tell* that **household linen** was formerly bequeathed from **one generation to another.** *Mention* the **antiquity** of linen-making—cotton fabrics much more modern.

(3) The **flax plant** is largely **grown** in Ireland, Holland, Belgium, and Russia—

(*a*) It is **about two feet high**, and bears narrow leaves and pretty blue flowers;

(*b*) But its **value** lies in its **fibrous stalk**, which makes linen.

(4) The plants are **pulled** as soon as they have done flowering, and **dried** in the sun:

(*a*) Tied in **bundles** they are either **water-retted** or **dew-retted**;

(*b*) After being **sun-dried** the bundles are **scutched** or beaten to **break the skin and pith**;

(*c*) And lastly are **heckled** or combed into "**raw flax**."

(3) *Associate* **places and products** in the phrases "Irish linen," "brown holland," "Brussels lace" (made of finest flax-thread). *Note* that in **ancient times** it was commonly grown **in England.**

(*a*) *Exhibit* picture or specimens of plant. *Mention* "**linseeds**" and their products (**oil and meal**).

(*b*) *Show* long, slender, branching **stalk**—*bruise it* to show **pith**—test toughness of **fibre.**

(4) *Describe* this as the **flax harvest.**

(*a*) *Explain* this as process for **removing pith** from the fibre—if "water-retted" the bundles are placed in **shallow pond** or stream, and kept there by weighty stones till "retted" or "rotted."

(*b*) *Explain* that **water** having **decayed the useless parts**, the fibre is unimpaired and simply wants clearing of those other parts.

(*c*) *Explain* heckling as **drawing the fibre** through a peculiar **kind of iron comb**; *name* the result of this operation as "**raw flax**" fine enough for coarse linen cloth, but needing to be **heckled over and over again** through finer combs for making fine linen, lawn, or lace.

STAGE III.

(1) Canvas, sail-cloth, twine, string, and rope are **made from hemp.**

(*a*) Hemp is **a plant** belonging to the same order as the common nettle and the hop; it grows **wild** in Asia, but is **cultivated** in Europe.

(*b*) Hemp **fibres** are **strong and coarse**; prepared similarly to flax.

(1) *Exhibit* **samples** of each—*note* strength and **coarseness** of fibre as *compared* with linen-fibre.

(*a*) *Specify* India and China in **Asia**; and Russia, Italy, Holland, and Germany in **Europe**; *add* United States and the Philippines as other **sources of supply.**

(*b*) *Exhibit* some **tow**—*note* that the **bast** of other plants is sold under the name of hemp.

PLANTS WOVEN INTO FABRICS—*Continued*

Objects and Apparatus.—Samples of Raw Material, Fibre, and Spun Thread, and of the various manufactured products dealt with under the headings of the four plants named; Wall-pictures or Specimens of the Plants; three Thermometers and some Boiling Water; a Piece of Fur.

MATTER SUMMARISED.	GENERAL METHOD.	DETAILED HINTS AND SUGGESTIONS.
(2) **Gunning-cloth**, sacking, floor-cloth backings, and tarpaulins are made from **jute**; also **cordage**. (*a*) Jute is a **plant** of the same order as the lime-tree, and is **cultivated** extensively in **Bengal**.		(2) *Exhibit* samples of any of these *to note* very great **strength of texture**. *Refer briefly* to **rope-making**. (*a*) *Mention* that the **bast** of the **lime** is used for making Russian **mats**. *Say* that while **Dundee** is the chief seat of the **modern jute manufacture** in Europe, this textile industry had long **flourished among the Hindoos**.

CONCLUSION.—In recapitulatory review *reverse the order of procedure* (which has been to work from the known to the unknown—from the familiar fabric to the unfamiliar plant which produced it); *begin to question* on the **plant**, its growth, cultivation, and manufacture, up to **the finished product**. As a *final exercise* let selected children come in front and group all the specimens and pictures used in the Lesson (which have doubtless become mixed up as they have been laid down haphazard) into four groups corresponding with the four plants dealt with.

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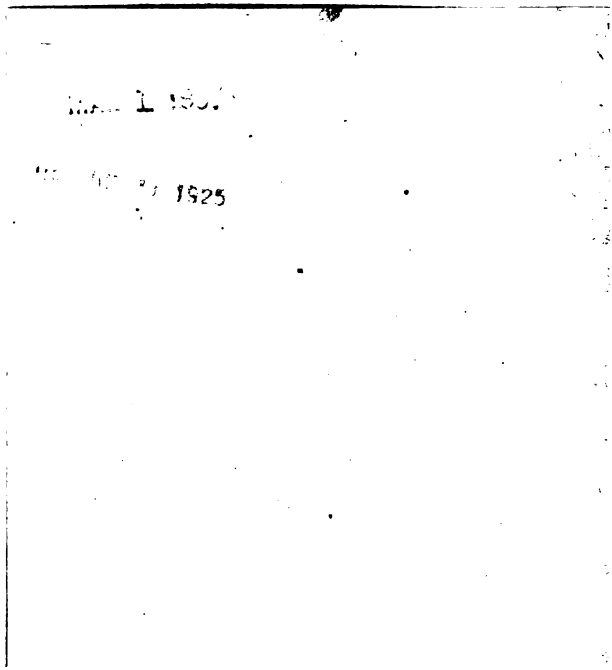
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